

Faculty of Humanities

**Innovative Financing for Urban Rail in Indian Cities:
Land-based Strategic Value Capture Mechanisms**

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**This thesis is presented for the Degree of
Doctor of Philosophy
of
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DECLARATION

To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Human Ethics: The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00261), Approval Number # HURGS-03-14.



Signature: ...Satya Sai Kumar Jillella.....

Date: 29th September 2017.....

ABSTRACT

Cities worldwide are seeking to build new urban rail as a sustainable mobility solution. All Indian cities with over 1 million population, are contemplating to build new urban rail and operational metro rail lines have significant expansion plans. All projects have political and policy pushes but are limited by funds. This research has therefore proposed a new funding system involving land-based 'strategic value capture' (VC) mechanisms to finance urban rail for Indian cities.

The research hypotheses are: first, urban rail driven accessibility improvement leads to gain in land value uplift; second, urban rail projects can be financed through a VC mechanism; third, the frameworks can be applied to other emerging cities.

Literature from global best practices identified the key challenges and opportunities for Indian cities to apply VC concepts. Many cities report lack of knowledge on VC concepts and their implementation but the potential is obvious as stakeholders are willing to pay provided they can see the transit value proposition.

This research therefore pursued the people's 'willingness to pay' (WTP) for rail accessibility benefit using the case of a Bangalore metro rail corridor. The results demonstrated the people's WTP was 25% to 42% more for transit proximity within a 1km radius. This is extremely promising but perhaps, more importantly, the research disclosed the emergence of a polycentric transit-oriented development (TOD) around Indira Nagar station, suggesting that a TOD strategy is likely to work in India. The research therefore developed an eight-step Strategic Rail Impact Assessment (SRIA) framework as a methodology to assess the value proposition and aid VC decision-making for emerging cities wishing to establish a polycentric city based on urban rail.

The next step was how to procure urban rail financing from the SRIA Framework. The research drew upon global best practices to develop a six-step "Strategic VC" (SVC) Framework offering a platform to formulate the land-based VC urban rail financing process from planning to operations involving stakeholders. A core element of this is a participatory stakeholder approach providing an effective tool to complement the VC process. Further, the Bangalore research uniquely applied some deliberative democracy (DD) techniques to enable participatory stakeholder engagement in the VC

delivery process. This was highly successful providing equity and clarity in decision-making. This was quite new in Indian government decision-making, thus a four-step "Participatory Strategic Value Capture" (PSVC) Framework using DD techniques was created as an add-on to the SVC platform.

The final step in providing this combination of polycentric development and urban rail is procurement. Indian cities are now mandated to unlock private participation in building urban rail, so to guide cities in how to achieve this the research developed an innovative "Rail Co-Creation Framework" (RCF) to shape the VC sponsored urban rail PPP model for Indian cities.

The four frameworks and strategic interventions developed in this research are novel contributions in India and apply to other emerging cities as well. This research empowers policymakers, planners, government agencies, and private players to orchestrate land-based VC funding to urban rail as a means of creating polycentric city outcomes as well as quality, sustainable mobility outcomes.

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DEDICATION

I would like to dedicate this thesis to my wife Dr. Rohini, son Saran, daughter Spurthi, my mother and mother-in-law. Especially thanks to my wife for her passionate support, patience, understanding and sharing of the financial burden throughout this doctoral research has made this all possible.

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Statement of Contribution of Others

All of the written materials submitted as part of this Ph.D. by Publication were conceived and coordinated by Jillella Satya Sai Kumar. The majority of the calculation and writing for each publication was undertaken by Jillella Satya Sai Kumar.

Signed detailed statements from each co-author relating to each publication are provided as appendices at the back of the volume (Appendix 1).

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http://wricitieshub.org/sites/default/files/Conference_proceedings-%201_0.pdf

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1.INTRODUCTION

Rapid urbanization challenges the cities of the 21st century, especially emerging economies. Though urbanization is an indicator of vibrant development, rapid urbanization causes a host of mobility problems to many cities. Low travel speeds, increasing pollution, frequent congestion, high parking demand, and overcrowded buses with long routes are well known to impact on the quality of life in these cities. “Poor urban mobility can negatively impact on the fast-emerging developing economies where cities are the epicentres for such growth (Jillella et al., 2015).” Cities worldwide are now investing into “rail transit systems as a multifaceted solution to address a range of those urbanism challenges (Suzuki et al., 2013; Newman et al., 2013).”

Newman and Kenworthy (2015) stated that “a second big urban rail revolution is trending across the World.” The ‘trend back to urban rail’ is now happening across countries in US, Canada, Australia, Europe, the Middle-East and in Asia. The traditional car-dependent cities and oil-rich Gulf region cities are now building urban rail (Newman et al., 2013; El-Geneidy et al., 2013; Gourram et al., 2016) - signposts that future mobility is built around the rail. All of these trends were based on the increased speed over the speed of traffic that is most evident in Asian cities, plus trends towards re-urbanization around TOD’s that are increasingly the sites for knowledge economy jobs as well as increased accessibility (Newman and Kenworthy, 2015).

Chinese and Indian cities embraced this trend with great eagerness as 82 Metro rail projects were planned or built in Chinese cities in the past decade and 51 Indian cities. “In India, currently metro urban rail is operational in nine cities with a 379km network built, with another eight cities constructing 277km of the metro rail network and a further 20 cities have rail transit under initiation with any city over a million now eligible for Federal help (Metro rail news, 2017).” All projects are politically approved but are struggling for funds to construct such highly capital-intensive rail transit projects.

Presently many urban rail projects are based on the Delhi Metro joint venture (JV) model with debt/equity ratios of 1.5:1 having state and central governments equity shares and about 60% raised through debt financing from donor agencies (DMRC, 2017). Seven out of 10 operational metro lines followed this model (NewsClick, 2017). This government guaranteed funding model is now shrinking due to competing demands, and it is grossly insufficient to fund the planned urban rail expansion. “This is a problem worldwide leading to the question of how can urban rail transit systems be funded and financed? (Gadgil, 2011).” This model underscores the need for a paradigm shift from the traditional budgetary funding dependence to innovative financing options to construct the urban rail ((Jillella and Newman, 2016; Peterson et al., 2008; Suzuki et al., 2013; Newman et al., 2016). The Indian urban rail dream is now at a crossroads to figure out alternate innovative financing mechanisms to sustain it. This Ph.D. research proposes a new financing system involving land-based “strategic value capture” methodology to fund and finance urban rail for Indian cities.

Most Japanese cities, Hong Kong, Singapore, and Copenhagen have demonstrated that urban rail transit can sustain funding and returns by integrating land development plans with the transit network (Cervero, 2010; Cervero and Murakami, 2009; Suzuki et al., 2013). “The use of value capture (VC) mechanisms is gaining momentum across cities worldwide as a solution to transit funding and financing (McIntosh et al., 2014; Suzuki et al., 2013; Newman et al., 2016).” Studies in European, Australian, and US cities reveal that proximity to urban rail frequently increase property values enough to balance all of the rail transit capital costs captured through a portion of their incremental land or property value (Suzuki et al., 2013). In Bogotá, during 1997-2007 period de-valorization through betterment fees contributed to about US\$ 1.0 billion, and about US\$ 1.1 billion estimated for 2008-2015 (Peterson et al., 2008). A few Cities in India namely; Mumbai, Hyderabad, Ahmedabad, and Bangalore have also attempted tapping urban land values as an additional source of revenue but could generate only small proportions using tax-based passive revenue instruments (Jillella, 2012). Unfortunately, there is limited research about implementation aspects of the VC process to build urban rail in developing countries (Suzuki et al. 2013). Hence, this research now addresses what kind of a mechanisms and interventions are

appropriate for mainstreaming the VC delivery process to fund urban rail projects for Indian cities and whether this is relevant to other emerging cities.

The underlying success factor for any new financing option depends on “stakeholders are willing to pay” provided they are aware of the urban rail value proposition. Therefore, the quantification of the “willingness to pay” (WTP) for transit accessibility is likely to be critical to VC implementation. Unlike the cities of the developed world, the availability of reliable and organized land value data is a big challenge in many emerging cities due to various reasons. There exists a huge gap between data availability, consistency, and reliability. Therefore, the available impact assessment methodologies cannot be directly applicable in developing countries due to database challenges and limitations. There is a need for a simplified predictable transit econometric value impact assessment methodology matching the data constraints of emerging cities (Jillella and Newman, 2017). This research, therefore, will demonstrate a method by quantifying the people’s ‘willingness to pay’ (WTP) for rail accessibility benefit using the case of a Bangalore metro rail corridor. Based on the case study learning, this research will then try to develop a methodological framework with guidance to quantify the rail impact value proposition for emerging cities matching their database challenges.

Once a potential revenue source is defined it is then necessary to define processes that can enable stakeholders to develop partnerships that can deliver the rail projects. This research therefore examines the interventions, and various means of beneficiary and stakeholder participation approaches to help define the VC delivery process; this is demonstrated using the case of Bangalore metro rail. The demonstration is then generalized into a series of Frameworks that can enable other cities to follow the research outcomes.

Recently, the Government of India approved a new Metro Rail Policy 2017 which mandates Indian cities to unlock private participation in building urban rail. The traditional flawed fare box driven revenue models are grossly inadequate and unattractive to private investments (Suzuki et al., 2013; Newman et al., 2016). In India, a few private-led rail ventures were piloted with fare-box driven revenue models but

miserably failed, and that subdued their participation interest (Indian Express News Report, 05 Sep 2017). How to make urban rail initiatives attractive to private investments and sustain them remains a challenge. This research, therefore, developed an innovative framework to shape the VC sponsored new age urban rail PPP model for Indian cities and to generalize their potential for other cities.

Though many Indian cities have legislative backup and policy support to implement VC mechanisms, however, the lack of a holistic framework, guidance and robust implementation mechanism have failed them to generate any sizeable revenue till today to fund urban rail transit. There are many inadequacies in current research in understanding the links between land use, mobility, and financing to suit cities in developing countries. Many Indian cities are in need of new urban rail funding mechanisms to fund the integrated transit and dense urban land development around. However, there exists limited research about the implementation aspects of value capture process and non-fare box based revenue models to fund or to attract private investments to build urban rail projects in cities of the developing countries. The present research plugs this space by introducing a “comprehensive ‘strategic value capture framework from planning to implementation’” to suit emerging transit cities in the developing world.

These research findings, models, interventions and frameworks are designed to be replicable and applicable to cities across the globe, particularly in developing countries where new urban rail building is now flourishing. The research that was conducted as part of this thesis was an action research project as part of an AusAID Public Sector Linkages Program between the Australian Government and the Government of India, with the Government of Karnataka. It was conducted by Curtin University in partnership with the Indian Institute of Science, Bangalore.

The Ph.D. research aims, objectives and thesis structure are set out below:

1.1. Research Aims

The “overarching question” this Ph.D. research seeks to answer is:

“Does land-based strategic value capture enable the financing of urban rail for emerging cities like Indian cities, and if so, what mechanisms can assist in mainstreaming?”

To address the above question, this research by publication primarily aims to:

1. Qualitatively review global best practice and to assess specific challenges and opportunities to implement VC funded urban rail financing for emerging cities like Indian cities;
2. Analyse the economic willingness to pay for urban rail accessibility benefits building simplified econometric models for the Indian cities context.
3. Develop a strategic VC process framework to guide the delivery of VC-funded new urban rail for Indian cities and other emerging cities;
4. Develop a stakeholder participation approach applying deliberative democracy (DD) techniques to help define the VC process equitably and efficiently; and
5. Develop a framework applying co-creation principles to mainstream private investments to build VC based urban rail PPP projects for Indian cities and other emerging cities.

1.2. Research Objectives

The first aim is to draw upon multiple case studies through a literature review analysis exploring global best practices seeking opportunities and leverage points that apply to the developing countries context. The second aim is focused on assessing the urban rail accessibility benefits through land value uplift using appropriate econometric modelling. The other three aims are dealt with mostly from the solution delivery perspective through process-oriented guiding strategies and interventions similar to the kind of frameworks developed by groups such as the World Bank. The study attempts to achieve these aims through the following specific objectives:

1. To review ongoing and global best practices of various VC interventions to build urban rail and identify key issues and potentials to adopt in Indian cities.
2. To develop an econometric rail impact assessment methodology to assess the WTP potential for the transit accessibility in Indian cities using a case study.

3. To develop a VC strategic delivery process framework to structure the “VC based urban rail financing processes” for emerging cities.
4. To strengthen VC delivery aspects, apply a deliberative stakeholder engagement approach to VC based urban rail financing project and demonstrate through a case study.
5. To develop a co-creation process framework to attract and execute VC driven PPP funded urban rail financing model for Indian cities.

To achieve these research aims and objectives the hybrid publication research was developed with five publications (two journal papers, one book chapter, two manuscripts) supported by an exegesis. The interaction among research aims, objectives and manuscripts are illustrated in Figure 1. The detailed research structure adopted in the research is highlighted in the following section.

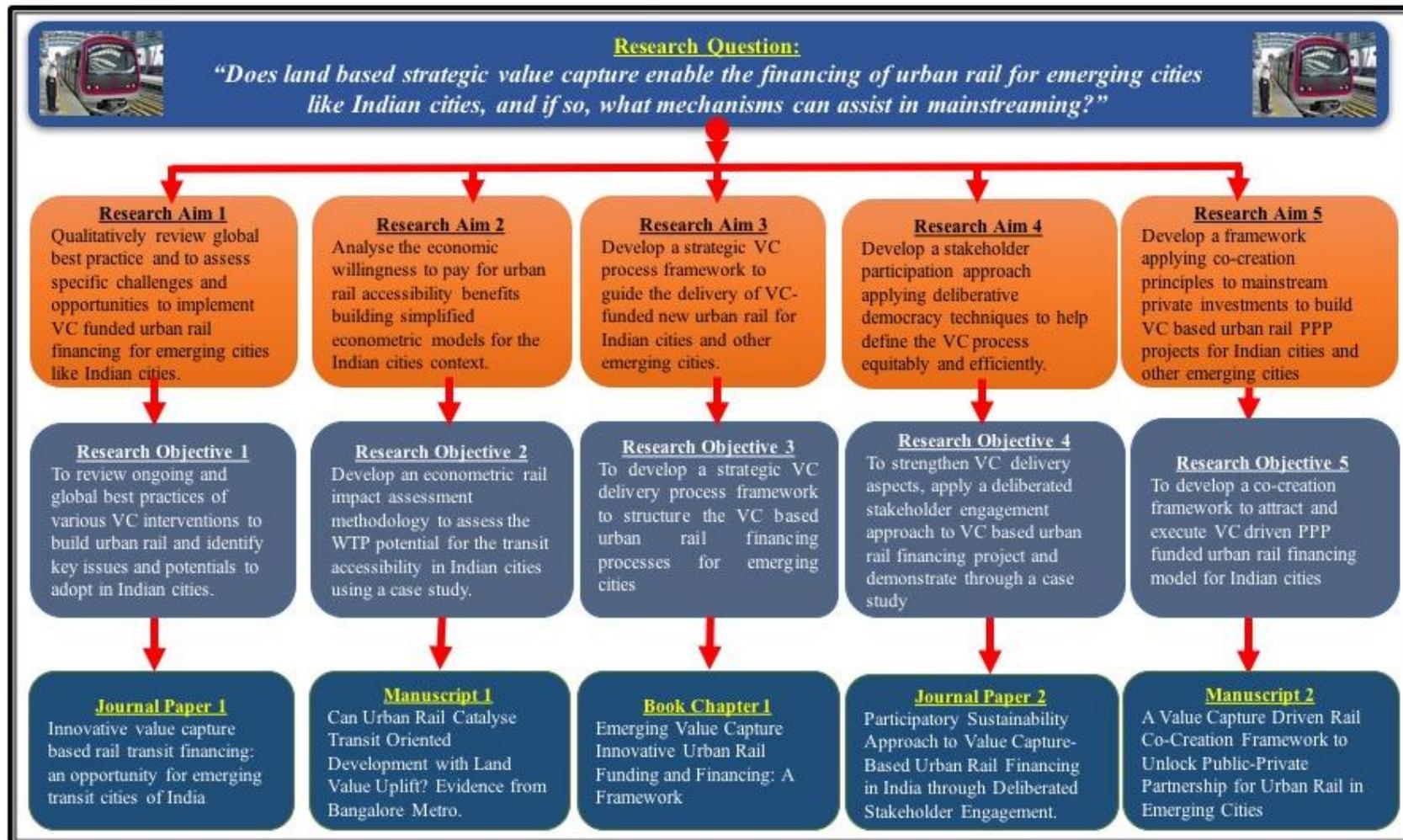


Figure 1. Schematic diagram illustrating the research framework, and the connectivity between the research question, aims and objectives.

1.3. Research Structure

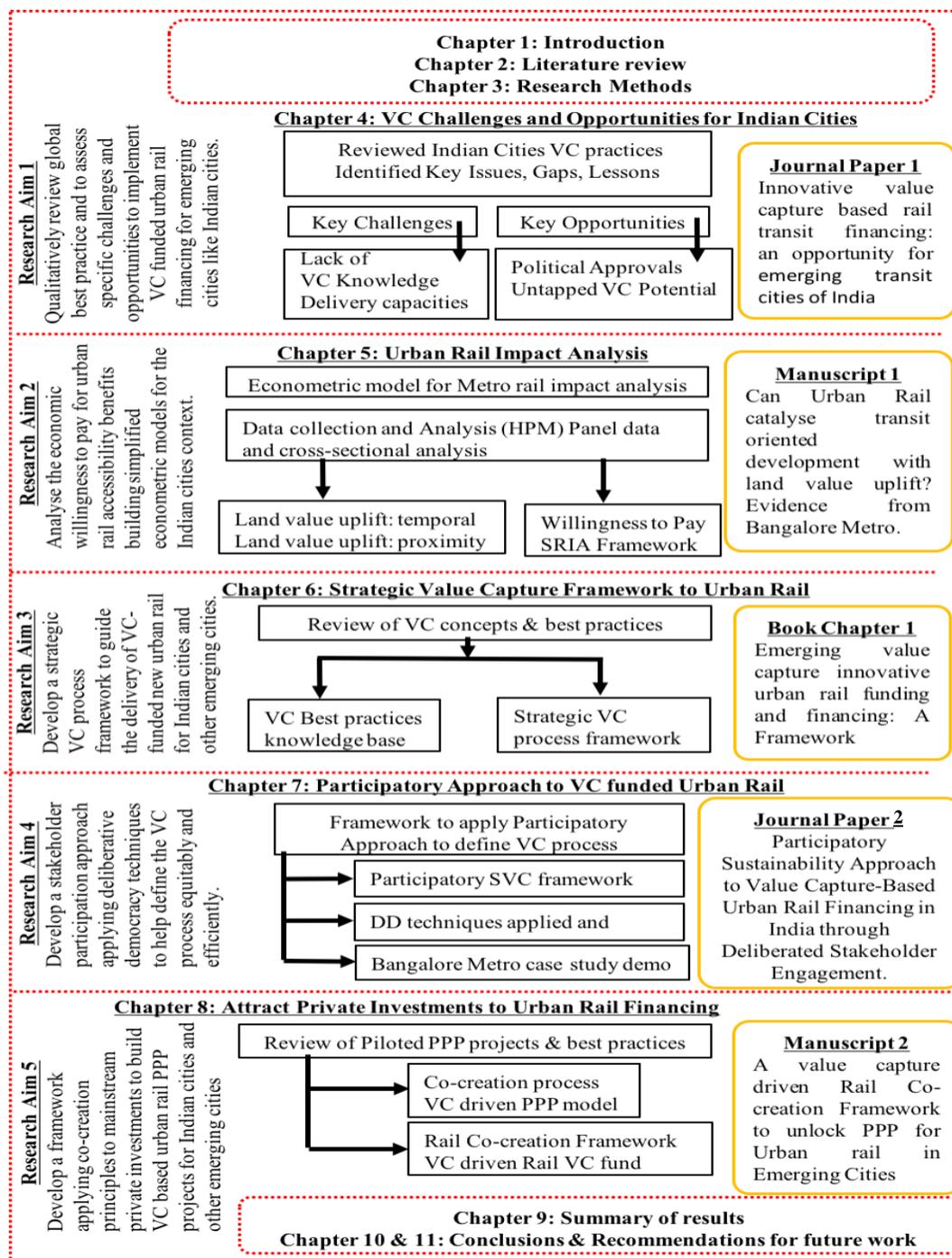


Figure 2 Schematic diagram illustrating the hybrid thesis research structure, and development of each publication.

This hybrid research by publication is shaped around five academic papers with each one focusing on strategic aspects of the overall research objectives with interactions between the research aims, data sets used and broad research methods adopted to address the core research question as illustrated in Figure 2. The outcomes of each paper were consecutive and in combination explore innovative land-based VC funding, and financing solution approaches to build urban rail for Indian cities. The research conducted as part of this thesis was multidisciplinary and with cross-sectoral collaboration focus.

The thesis begins with the Exegesis and includes a brief introduction, followed by a summary of the literature review. The Exegesis further includes a short account of research methods adopted, a brief summary of the five publications overview with a summary of results that mainstream land-based VC funding and financing to build urban rail for Indian cities. The Exegesis ends with conclusions and recommendations for future work. The publications along with the contributions from each author are included as part of the appendix.

The research conducted in *Journal Paper 1* mainly focuses on the ongoing Indian urban rail VC practices and global best practices to identify gaps and also potential opportunities to adopt VC as a mainstream funding source. This review analysis identified two major critical gaps as lack of VC knowledge and capacities as significant challenges to VC implementation. Subsequently, the research focuses on quantification of the actual rail impact value proposition which is a prerequisite to any VC application.

Manuscript 1 conducted an econometric modelling analysis using the case of Bangalore city metro rail choosing a pilot corridor for assessment. The key learnings offered by the case study identified appropriate data attributes with the temporal and spatial analysis taking into consideration the database consistency challenges in developing countries. This helped the research to develop a macro-level simplified econometric methodological framework “Strategic Rail Impact Assessment” (SRIA) for the emerging cities context. The following three publications of the research focused on recommendations on VC orchestration, and strategic interventions that enable the first two paper’s approach to be delivered.

The two critical gaps that were identified by *Journal Paper 1* are addressed through the next two publications - *Book Chapter 1* and *Manuscript 2*. Primarily *Book Chapter 1* draws upon the review of global best practices that first creates a successful VC experience. Second a detailed six-step strategic VC framework on the VC delivery process is developed from planning to implementation for Indian cities. Now the research with its other publications focuses on various strategies and interventions to improve and strengthen the VC process.

Journal Paper 2 provides one such unique response applying “stakeholder engagement using Deliberative Democracy (DD) techniques” in defining the VC based delivery process. Additionally, after reviewing piloted domestic urban rail PPP initiatives and global best practices, *Manuscript 2* provides a Rail Co-Creation Framework (RCF) to attract and sustain private investments to fund VC-based urban rail projects.

In summary, the outcomes of this research significantly provide a capsule of solutions providing innovative and guided approaches that can contribute to creating new knowledge orchestrating and delivering VC-based creative financing options to build urban rail from planning to implementation for Indian cities. The proposed VC driven co-creation process and application of DD techniques in VC delivery process are unique and potential new knowledge to implement VC driven PPP based urban rail for Indian cities and any emerging cities. The research outcomes have a built-in flexibility to apply it either to the public sector or private sector initiatives and are not limited to use as joint PPP collaboration models but are seen to be preferable using this mode of delivery. The proposed four innovative frameworks namely PSVC, SVC, SRIA, and RCF in this research can be applied to the benefit of other emerging cities globally. Thus, the current research is an attempt to introduce a comprehensive ‘strategic value capture framework’ to define the value capture process from planning to implementation within the developing world context with innovative strategies and interventions incorporated to fund and finance new urban rail for emerging cities.

2 LITERATURE REVIEW

As this research by publication draws upon a multiple case study focus, an extensive literature review was conducted as part of each publication to synthesize the outcomes. All this together creates successful VC knowledge and experience through global best practice. This section summarizes the literature review conducted as a part of the thesis highlighting only new insights to avoid duplication. This review starts with the latest trending topic of new Metro rail policy to set the context. The “detailed literature reviews—on each subtopic in this section—are included in the full-length manuscripts.”

This literature review in the context of urban rail financing covers: the new Metro Rail Policy, 2017 of India as a context for VC and private players; private sector partnership perspectives in an urban rail context; the Entrepreneurial Rail Model; what is VC and how does it work; why a participatory approach in the VC context; deliberative democracy techniques in the VC context; and a summary.

2.1 The New Metro Rail for Indian Cities: An Opportunity for VC & Private Investments

All million plus populated Indian cities are mandated to build new urban rail toward sustainable urban mobility solution by the federal government. In this context, the Government of India recently approved a new Metro Rail Policy 2017 which mandates for states to include private players and land-based innovative financing options among others in the provision of metro rail services. So far, all operational Indian urban rail projects have mostly followed the Joint Venture (JV) model where the costs of the project are shared between the state and central governments on equity and the balance raised through debt financing. In recent years, the pressure on State and Central governments are quite evident with huge funding shortfalls and delays in budgetary grants. “Indian cities are facing a daunting funding challenge to build urban rail systems (Indian Express, 2017; Business Standard, 2017; ICRA report, 2017).“

Contrary to the emerging PPP practices of US, Canada, Australia and the longer-term practices in parts of Asia, there is limited PPP experience in India, particularly in the urban rail sector (*Manuscript 2*). Currently, six metro rail project lines are being piloted with private investment in

India but there has not yet been a successful experience; a few of them have already been abandoned due to flawed revenue models and lack of equitable risk-sharing. This research (*Manuscript 2*) conducted a review of all currently piloted Urban rail PPP projects in detail from the perspective of what worked and what did not.

This policy shift is setting the trend for a paradigm shift from a focus on conventional budgetary financing to innovative financing options mostly based on land value capture based funding to enable private investment. With the new policy mandate for PPP, the country has now entered an inflection point in urban rail – as long as they can find a process or set of processes that can work. The core challenge today for many cities is how to attract, execute and sustain such private funding to build the urban rail. Land development based private sector partnership offer a viable alternative for bridging the gap of urban rail financing. In this context, this research (*Manuscript 2*) developed a ‘Rail Co-creation Framework’(RCF) to attract and shape a VC sponsored Urban Rail PPP model as a new age solution using the co-creation process.

Overall, the new policy is more responsive, allows private investments with a low-cost debt capital model that enables innovative financing mechanisms, transit supportive developments and last mile connectivity. It is therefore a step toward sustainable transit-oriented development and funding. India can soon potentially emerge as the largest market for urban rail PPP’s if it can be demonstrated and shown to create confidence amongst the markets and city governments across the nation. .

However, architecting such engagements requires skill beyond engineering and economics. This model calls for specialized skill in the areas of marketing, managing, negotiation, urban design, town planning, deliberation, collaboration, and coordination. The public sector needs to either build such capacities or hire/acquire such expertise as required to implement such engagements. Creating a project-specific SPV model staff with all the needed skills will help to meet such a requirement. Many urban rail PPP’s have a long gestation period and long-term contracts that will need all of the above skills. The RCF approach was drawn up to suggest how flexible concessionaire agreements could address the uncertainties in such projects over the years; it

promotes the concept of joint development of ideas when uncertainty might happen.

Manuscript 2 set out the rationale for private sector involvement in urban rail. The next section briefly reviews private sector partnered urban rail experiences.

2.2 Private sector partnership perspective in urban rail context

Experiments in private sector rail partnerships have begun in cities in the US, Canada and Australia though they have decades of good experience in Hong Kong and Japan; all have successfully tapped private sector investments for new urban rail through land development (Suzuki et al., 2013).

PPP engagement models work on an effective collaboration basis between public and private sectors, each providing their valued contributions to its success. The rationale behind the private sector financing in urban rail is first and foremost bridging the funding gap. Second, private sector involvement can help achieve efficiency gains through their skilled resources, flexibility, experience, innovation, technology access, and comprehensive project strategy. Third, private investment can provide an opportunity to unbundle and shift the risk and rewards of new investment from the public to the private sector and hence may lower the overall cost or at least reduce the capital debt issues faced by most governments.

Worldwide many cities have tried out PPP models to bridge the financing deficit for expensive urban rail systems. Phang, S.Y. (2009) [p 23] reports that “globally, there was a wave of privatization swept through the transport sector in the mid-1980s, due to poor public-sector performance, fiscal crises, and technological advances.” This wave resulted in the deregulation and privatization across several sub-sectors namely: airlines, roads, ports, airports, intercity rail, and bus services. However, the private sector appetite toward capital-intensive urban rail systems was found to be low due to higher risks, low returns, and challenges associated with in comparison to others. Japan and Hong Kong, China were the only exception. They proved that by providing an enabling environment through a sound legal, institutional and procurement framework could play a vital role in attracting and mobilizing private player investments to build urban rail.

Over the years, the public-private sector agreements matured into various structures which can be broadly classified into three major groups: first outsourcing services, second innovative contracting and third innovative financing.

2.2.1 Outsourcing

During the early 1990s the operate & maintain (O&M) concession strategy became a popular way to seek private sector participation in urban rail. This model ensured that the new private owners/operators needed only to invest in O&M with no concern for capital investment recovery. Robelo (1999) stated that “Argentina pioneered PPPs in urban rail by outsourcing all its seven lines in Buenos Aires with 20 to 25 yearlong concessions for private entities to operate services and execute investment plans defined and funded by the state.”

2.2.2 Innovative Contracting

Since then, PPPs in urban rail grew steadily and became popular for development, operations and maintenance areas of urban rail in North American cities (Robelo J., 1999). Manrique M.G., (2010) stated that “New Jersey Transit’s Hudson-Bergen light rail transit system was developed and is being operated by a private consortium under an innovative design-build-operate-maintain (DBOM) arrangement.” Many other transit systems, including the Metropolitan Transit System in San Diego, TriMet in Portland, Ore., and Dallas Area Rapid Transit (DART), have used their light rail systems with private capital investments to attract transit-oriented development (TOD) projects (Newman P., 2015; Manrique M.G., 2010). Over a period, various forms of PPP procurement models have evolved which mainly differ regarding ownership mechanisms, usage rights, and obligations of the concessionaire. The popular forms of PPP engagement models are given in *Manuscript 2*.

2.2.3 Innovative Financing

In this context, international experience demonstrates that rail plus land or property development opportunity is gaining attention as a major pull factor to enable private funding into urban rail. Sharing a captured fraction of the improved land values due to a new rail initiative and providing the opportunity to partner the development impetus along the rail corridors is becoming an attractive proposition to private sector investments and participation (Suzuki H., 2013). Land and

property developments around transit stations and selling air rights to property developers above stations are increasingly a popular practice in Asia to generate long-term revenue and to attract private investors (Suzuki H., 2013). For many years the cities of Japan and Hong Kong China have constructed various forms of rail transit by tapping private sector investments through land development. Tokyo subway rail and new towns rail links have been popular with public-private partnerships.

In a study of “Alternative Funding Mechanisms for Public Transport in Perth,” McIntosh et al. (2014) determined that “value capture mechanisms can be strategic or project based. The Gold Coast Transport Levy, which is collected across the whole of the Gold Coast municipality to help fund and operate the new light rail, is an example of a strategic value capture mechanism. The Metropolitan Regional Improvement Fund, in Perth, could also be seen as a regional strategic value capture mechanism. Project value capture mechanisms focus on the specific stakeholders that benefit directly from the transport initiative.”

“The project success based on innovative procurement and financial effectiveness involving private investors through land development can be found in the Mass Transit Railway (MTR) Corporation in Hong Kong SAR, China, and the Japan Railway Construction Agency (JRCA), a public corporation of Japan Railway, Japan.” The MTR experience can be considered as a highly fruitful and sustained business model which they are now taking to other cities.

McIntosh et al., 2014 stated that “both active and passive value capture could enable more significant private involvement in urban rail projects. If private financing is being used it is possible to involve private consortia in a PPP where not only do they bid to build, own and operate the rail system but they can also do entrepreneurial land development as part of their submission. In the case of private properties, many active VC mechanisms are available, for example: development of private ownership or government land that has been specified to be part of the bid process; joint development of government land with industry; leasing the property for parking or development as fee-based revenues; rental returns on government property; and leasing the space for other income. Thus, a combination of active and passive mechanisms could all be used to create

a Transit Fund and hence create financing opportunities for the rail project.” This is still fundamentally a government-led project however.

Globally, renewed efforts are underway by governments, city planners, and academia exploring innovative alternate funding and financing strategies. Among them, Newman et al. (2016) proposed the ‘entrepreneur rail model’ (ERM) which tries to bring private investment into a rail project at an earlier stage than the processes outlined above. The ERM concept is themed upon tapping private sector investments for new urban rail through land development assessed early in any rail route process. The next section briefly details on the ERM solution concept.

2.3 Entrepreneur Rail Model: Tapping private investments through land development

Newman et al., (2016 and 2017) proposed the ‘entrepreneur rail model’ (ERM) in the hope that a new age funding solution could be found that would create significantly higher economic value. The ERM core focus is to unlock land development in new activity centers around stations as the first step by inviting the private sector to show how they could integrate amenity-creation plus value through land amalgamation and thus be able to build or help build the urban railway that would unlock this value. The goal is to see how to make urban rail attractive to investors and the community.

ERM concepts can be applied if sufficient land is available for regeneration by the private sector either on a lease or sale basis with innovative development themes around stations. Alternately ERM allows pursuing joint development opportunities either with land-owners or with the government to induce activated development. “Such revenue potential identified upfront can create the capital to build the urban rail line. Further, ERM advocates for the Build-Own-Operate-Finance (BOOF) model with 100% private financing as the main target to remain as a self-sustaining project minimizing uncertainties. The ERM focus appraises the value for money regarding: travel time-savings; increased land values; agglomeration of economies in activity centers; land development efficiencies and environmental gains due to reduced automobile dependence.” ERM (Newman et al., 2016) [Section 3, p.25] at a conceptual level recommends “three broad approaches to deliver namely: unsolicited bids; government call for tenders; and, government controls

internally through a new government agency. ERM also suggests three ways of funding and financing such projects as: totally private capital; substantial private and some public capital; and some private and substantial public capital. ERM proposes a “Transit Investment and Land Development” unit established in Treasury to oversee the bidding process for ERM projects and select the bids based on set financial criteria, land development criteria and transit criteria. After the private consortia have been chosen then, ERM recommends a new entity “Entrepreneur Rail Delivery Agency” to facilitate the delivery process. This agency would act as a sub-division of a city redevelopment agency and enable the land acquisition, zoning, and land assembly to unlock land development around the stations.”

ERM provides the concept and sets direction with macro level guidance for private sector engagement in an Australian cities context and can be adapted to developing countries context as well. The Australian Federal Government has now created a City Deal process to enable the ERM approach to be tried with their role being to help guarantee the financing risk.

“Turning to the private sector for financing can only work with urban rail if there is a necessary return. Most rail systems, even the profitable ones in Japan and Hong Kong cannot make such a return from the fare box. The only way to enable sufficient return is if the private sector can make a profit out of land around stations (Jillella and Newman 2016). “

The next section briefly discusses the VC concepts and how it works.

2.4 What is VC and how does it work?

“Value Capture as practiced widely in the world is based on the principle that private ownership of land and buildings benefit from Government investments in infrastructure and policy decisions of Governments (for example, change of land use or FSI). Appropriate VC mechanisms can be deployed to capture a part of the increment in value of land and buildings. In turn, this collected share of VC revenues can be used to fund the capital costs of the investments made and related allied project interests or to a new project being set up for the public by the Central/State Governments and ULBs. This VC generates a virtuous cycle in which value is created, realized

and captured, and used again for project investment. As the additional value is generated by actions other than landowner's direct investment, value capture is distinct from the user charges or fees that agencies collect for providing services. It gives governments the opportunity to launch new projects, even with a small resource base. For the private sector, VC financing is a chance because projects are properly planned and backed up by the Government either by an executive authority or risk sharing (Ministry of Urban Development Policy report, 2017).“

The *Book Chapter 1* reviewed and provided the concepts of the VC rationale, VC definition, VC stakeholders, Transit Accessibility Impact Assessment, VC mechanisms including both passive and active VC mechanisms. These are described in detail within an urban rail context along with global VC implementation experiences.

This research established that an urban rail journey of value creation starts from the planning stage itself with speculation-created land value uplift in proximity zones. Therefore, this research recommended applying the VC process from the early stages of the project lifecycle to be more beneficial and optimized. Arena (2013) shared the project-based approach in a High-Speed Rail context and this is explained below, adapting it to the urban rail context. This explanation is essential knowledge from the perspective of the SVC framework suggested in *Book Chapter 1* to apply VC from planning to operations phase of the project lifecycle.

Typically, urban rail projects consist of three distinctive phases. Phase 1 is the planning period; phase 2 is the construction period and phase 3 the operations period. Value capture mechanisms differ in each step. Phase-1 is particularly challenging as there is no infrastructure in place to generate and prove accessibility benefits though this the time to be evaluating land development potential. At this stage, only a functional special purpose vehicle (SPV) (JPA in US High-Speed Rail context) at project level will be formed to initiate the project design and planning. This phase has no infrastructure to generate accessibility benefits, but it can prepare alternative routes based on what are the most likely to provide the best value increase. This may involve government land that can be added to the project. It is essential as part of VC planning to identify the VC funding mechanisms upfront to the project for this phase in order to begin to estimate the potential extent

of private investment. Once a route is determined then the speculation in land value uplift will happen in anticipation of rail driven accessibility benefits and much of the value capture potential will leak away. “This value could be captured in the form of dedicated tax revenues, land grants, zoning variances, and development levies as long as they are applied before the speculation begins. The funding can be city/local, county/regional, state, or federal, or some combination of all four. These commitments are required by the underwriters that will float the bonds for construction or whatever financing mechanisms are used. The underwriters might also demand that a government entity guarantee interest payments should the revenue projections come up short (as the Australian Government City Deals are doing).”

Phase 2 is the construction and development stage. This stage is very capital intensive. The bonds are floated or private investors find their own financing mechanism to provide the cash necessary for construction of the rail and the start of land development. “If an SPV is used then it needs to be generating sufficient income to pay the interest coupons on the bonds, as most underwriter covenants prevent the use of bond capital to make interest payments.” Phase 2 offers few opportunities for revenues from private developers and phase 1 VC mechanisms continue.

The last stage is Phase 3 when urban rail operations begin. By this period the value of land will have significantly increased and hence private developers can be making substantial money from renting or selling property as well as from fare box returns and advertising if they are operating the rail system. “For existing properties in the infrastructure development envelope, special business improvement districts can be established to funnel a tax-like assessment to the SPV for their appreciated value. This approach is a simplified example of how value capture cycle could work (adapted from Arena R, 2013 US High-Speed Rail to urban rail context).”

2.4.1 VC Mechanisms to Capture the Value

The value capture concept is that “urban rail will increase land values when it is built, and this must be beyond what would happen anyway due to rising incomes and other economic activity. Various government mechanisms can capture these land value increases and put into a Transit Fund that can then be used to raise finance for building and to operate the rail system. Thus it can

involve private sector financing (for building, owning and operating) as well as government sources of financing, but in all cases, it will require a government funding mechanism to capture the value as the first step in unlocking the finance. The most common strategy to capture the value created by investment externalities is through different forms of VC mechanisms.”

However, “capturing the value in an acceptable, transparent and equitable way involves multiple methods and complex mechanisms.” McIntosh (2014) stated that “the VC mechanisms could be broadly categorized into active and passive VC mechanisms. Active VC revenue sources are revenue flows from active intervention such as buying property or creating a special levy on the station precinct, whereas passive VC revenue flows are more asset value dependent so funds come from tax based revenue flows without intervention to actively pursue the value directly. Such value capture financing (VCF) mechanisms are outlined below.”

Land development and land auction (leasehold to freehold)

The most direct value capture is for governments to build land banks through strategic acquisitions. Once a part is developed, the value of the remaining land rises, and the government can capture the entire increment by selling it. Such land banks can be sold in a phased manner to finance the development of urban rail or infrastructure development. Mumbai urban transport project funded to the tune of US\$ 1.2 billion from the sale of small land parcels in Bandra-Kurla in two auctions.

Tax Increment Financing (TIF)

TIF is a popular value capture financing mechanism in many developed countries, the USA in particular. In TIF, the incremental revenues from future increases in property tax or a surcharge on the existing property tax rate are ring-fenced for a defined period to finance urban rail or any other infrastructure investments.

FAR Sale

Currently, this is popularly used in practice in many Indian cities. The current Floor Area Ratio (FAR) across many cities is low. Therefore to improve the density and also a scarcity of developed urban land, an additional FAR sale is incorporated at a premium price. This premium FAR encourages vertical development and densification in urban areas. The sale proceeds of the premium FAR sold around station areas can be used for funding the urban rail infrastructure.

Impact Fees

Impact fees are levied, apart from the development charges, on new constructions within the defined urban rail influence zone. These fees levied to recover or share the funding of urban rail. These are collected during new construction approval granted and may vary depending on the location, the land use, and zonal regulations within the defined area. Impact fees are generally calculated based on the total cost of the project investment proposed or funding share proposed and the development potential within the influence area. This fee would require a project-wise notification.

Land Pooling Schemes (LPS)

LPS is a form of land procurement where all land parcels in an area are pooled, converted into a layout, infrastructure developed, and a share of the land, in proportion to original ownership, returned as reconstituted developed parcels. The share of the developed land is sold to finance the cost of the development as a betterment charge to cover the infrastructure costs. LPS is a common practice in Japan and Germany. Few cities from the Haryana, the Gujarat and Andhra Pradesh states used land assembly programs. These are also popularly implemented as Town Planning Schemes as well.

Air Rights or Joint Development

In densely built-up cities where land is scarce, there has been a trend in recent years to develop on top of areas like railway yards and stations either through joint development or exclusive sale of Air rights. The sale proceeds or profits earned will go for funding the urban rail investments. Air rights sale or joint development is now used across several Indian cities auctioning air rights on bus and railway terminals.

Betterment Levy

Betterment levy is a one-time upfront charge on the land value gain caused by public infrastructure investment. Great Britain for a period imposed a betterment levy equal to 40 percent of the land-value gain attributable to public investment⁶. Such levy is also exercised in the United States using a special assessment district, whereby annual levies are imposed on the district.

Land Value Tax

Land Value Tax is considered as the ideal value capture tool - used by countries like Denmark, Australia, and New Zealand - is an annual land-value tax on the increment of land value. Apart from capturing any value increment, it helps stabilize property prices, discourage speculative investments and is considered as least distortionary and most efficient among all value capture methods. However, the absence of transparent price discovery in Indian property markets and the poor state of land titles make its administration difficult.

“Active VC mechanisms can be applied to government-owned property or vacant public lands which benefit from the transit accessibility driven increased land values. The said revenues can be accrued if governments either sell their land holdings or sell the development rights to the land holdings. These can be collected directly by the consortium building the system or can be collected by the government into a fund used to pay the consortium chosen to build the transit and land

development. The revenue can be generated from government-owned property or from private land where owners are brought into a profit-sharing agreement with the consortium that has been chosen to build the system; all landowners will benefit from the transit accessibility-driven increased land values (*Journal Paper 1*).”

“In case of subway transit projects, the newly created underground space holdings around transit station area can yield more revenues through shopping or business activities as revealed in the case of subway projects of Hong Kong, SAR China, Japan, and London. The public transport financing practiced by Mass Transit Railway Corporation (MTR) in Hong Kong SAR, China and the Japan Railway Construction Agency (JRCA), a public corporation of Japan Railway are good examples of this active, development based approach. Hong Kong’s MTR co-developed the sites along the transit corridors and above the transit station rather than selling those sites. In 1993, the corporation financed about 22% of the operating cost of their transit system through property rental income. Similarly, the greater Tokyo’s private railways have practiced transit value capture through development on an even grander scale, building large new towns along rail-served corridors and cashing in on construction, retail and household service opportunities created by these investments (Suzuki et al., 2013, page 183). Figure 3 illustrates few selected VC mechanisms and application perspectives. “

“Active VC mechanisms can include betterment tax, beneficiary area levy, infrastructure levies, special assessment districts, developer contributions, density bonuses or sale of air rights. In Australia, the Gold Coast Transport Levy, which is collected across the whole of the Gold Coast municipal area, was used to help fund and operate a new light rail. The Transport Levy was able to provide the ongoing costs of operation and was used to induce state and federal capital for building the system. A Public-Private Partnership (PPP) model was made feasible based on such active intervention to create a fund to be used for raising the finances (*Journal Paper 1*).”

“Passive VC mechanisms are mostly on private land where the revenue flow is focused through ad valorem tax instruments, namely land value tax, capital gains tax, stamp duty tax, land tax, GST on land sales and any other land-based taxes. These will rise due to the increased accessibility from

the urban rail service and will flow into various levels of government. It is scientifically estimated the increased flow of funding can be hypothecated into a Transit Fund and used to attract financing from banks involving various combinations of the private sector and government. Passive VC mechanisms still require government actions but not directly in the marketplace; they can, therefore, be more politically acceptable but only if the government can afford to raise the loans. They do require Treasury Departments to hypothecate revenues, and this may impact credit ratings.” This is now happening in some US cities.

“Both active and passive value capture can enable more significant private involvement in the urban rail projects. If private financing is being used it is possible to involve private consortia in a PPP where not only do they bid to build, own and operate the rail system but they can also do entrepreneurial land development as part of their bid (*Journal Paper 1, Book Chapter 1*).”

VC MECHANISMS	Contributor /Benefactor		Framework & Coordination			Phase		Influence Zone		Context / Basis		Cost / Funding		Transit Ownership		Authority		
	Landowners	Developers	Taxing authority	Partnership	Others / Negotiation	BEFORE Transit Investment	AFTER Transit Investment	Around Station	Along Corridor	Entire jurisdiction	New development	Existing development	Upfront (capital)	Ongoing (O&M)	Public	Private	State / Central Govt.	Local Govt. (ULBs)
Land & Property Tax																		
Special Assessment																		
TIF																		
Land Sale & Leasing																		
Joint Development																		
Air Rights & TDR																		
Land Re-adjustment																		

Figure 3 Selected VC mechanisms and application perspectives (adapted from Vivek 2015).

2.4.2 Value capture governance model

“Value capture programs rely on establishing and maintaining goodwill among a wide range of public and private interest groups. This approach often requires a widely supported and collaborative process, and mechanisms to provide appropriate involvement from all groups, such

as the use of task forces, facilitators, and intermediaries (Langley, 2013).”

“Studies of high-speed railway stations in Europe and Asia found that a major factor in successful station precinct development programs is the presence of strong and consistent local leadership (ADEC, 2012). Persistent local leadership by Mayor Clover Moore was a major factor in overcoming NSW government resistance to the Sydney light rail extension currently being delivered. While political leadership is critical, sustained leadership that transcends administrative and policy change and maintains a consistent vision for the project is essential given the long-term nature of urban renewal and public transport investment.” Therefore, along with good governance, it is equally important to have a coordinated institutional setup with influential leadership (Cervero and Kang, 2012).

In this context, India has evolved a Special Purpose Vehicle (SPV) under a company law involving all respective agencies being on its Board. For example, the SPV for Bangalore Namma Metro is formed with joint shareholdings from Government of India, Indian Railways, and the State Government. In such an SPV model, it was noted that the committee on implementation, funding, and process drove operational advantages as everyone shared ownership (RITES, 2009).

2.5 Why Participatory Approach in a VC Context? How to Make it Efficient?

Engaging citizens in big urban rail projects would be expected as they are the ones who will make it work or not. However, there is minimal effort generally to engage citizens actively in the value capture process as outlined above. This is not only in India but there is very little published on this in other countries as well. In fact, “the success of value capture depends on stakeholder engagement and willingness to pay in the value capture process so it would seem sensible to engage early and engage creatively.” Without the involvement of civil society and community, the proposed value capture attempts could fail due to pressure from lobby groups and short-sighted electoral political gains. “Whether as a resident with transportation concerns or as a user of transit, streets or public spaces, a citizen's opinion is vital to the transportation planning process (*Journal Paper 2*).”

“In India, more particularly, after the 73rd and 74th amendments to the Indian Constitution, the decentralized governance framework has introduced a new dynamism into the overall process of participatory democracy (RITES, 2009). There are many consultations approaches in practice for community engagement in decision-making that seek to find broad support from all key stakeholders for a policy direction. It provides a powerful and effective way for communities to co-create a more sustainable future with public sector decision-makers and other experts.”

2.5.1 “Need for Participatory Stakeholder Engagement in a VC Context”

Holmes (2011) (p. 13) states that "engagement is not a single processor set of activities. It is an ongoing process or conversation that builds trust and relationship". Value capture works only when the beneficiary community sees that as value and are willing to pay. So, such shared interest concepts will get poor results if this is only viewed from the administration and financial management perspectives. “Many successful community engagement experiences envisage that having the general public and stakeholders engaged at the helm of the policymaking process transforms them as an agent of change and co-creator with a systematic pursuit of sustained collaboration (Smolka, 1999; OECD, 2009).“

Stakeholder participation and having a ‘voice’ and ‘role’ in the process could be a game changer for any new urban rail approach. This thesis incorporated the deliberative stakeholder engagement approach in defining and delivering the VC process deploying DD techniques. Further, to create a well-structured stakeholder engagement process which is critical to VC implementation, the thesis developed a Participatory Strategic Value Capture (PSVC) framework to incorporate stakeholder engagement as part of VC implementation (*Journal Paper 2*).

“A participatory approach, therefore, demands a major paradigm shift in the thought processes of government agencies and community. Furthermore, engagement processes require stakeholders to acquire specialized skills to have a successful collaboration. For example, Holmes (2011) [p.1] highlighted that government or public agencies might be required to develop new roles as enablers, negotiators, and collaborators. At the same time, the community may be necessary to demonstrate a willingness to be actively engaged in the process (and dedicate time to the process) along with

being sufficiently well informed to enable their participation and deliberation to be effective.”

This research adopted a participatory approach with stakeholder engagement across a strategic value capture process (*Journal Paper 2*). “Overall, the expected benefits from stakeholder engagement utilizing a participatory sustainability approach within a VC context include generating goodwill, removing uncertainty, and enabling community expectations to be at the forefront of decisions. Furthermore, it provides an opportunity to receive stakeholder support in the initial stages of the process and participation from the community helps to enable democratically agreed VC fund redistribution strategies. If such agreement happens, it can contribute to enabling the captured value to be re-distributed proportionately to related community support systems, along with the transit investment that was necessary to enable the transit to be built. Primarily, the participatory sustainability approach actively facilitates community and stakeholder involvement in decisions that affect them directly. However, in practice, undertaking stakeholder engagement in a democratic dialogue is essentially a multifaceted and multi-dimensional challenge (Ramanathan, 2001). The literature on stakeholder engagement emphasizes the need for community involvement to be far-reaching, inclusive, balanced, and facilitated through a democratic dialogue (Kenneth, 2006).”

2.5.2 Stakeholder Engagement Techniques: Can Deliberative Democracy tools be a Game Changer in a VC Context

“DD goes beyond the routine engagement techniques to ensure there are not just stakeholder but randomly selected citizens who can guarantee meaningful participation with inclusiveness, deliberation, dialogue, and acceptable consensus (Hartz-Karp, 2007).” To this end, DD is not a traditional approach to community engagement as this usually just invites stakeholders to have their say. “DD provides a powerful and effective way for communities to collaboratively problem solve and co-create sustainable outcomes together with decision makers and technical experts by having a third voice representing common sense and public good. Carolyn and Lars (2006) [p.20] state that DD advances richer forms of public participation that engage citizens in a structured dialogue around focused policy issues, and yields benefits to participants and sponsors that extend beyond the collection of useful information. These approaches seek to find “broad support” from

all key stakeholders as well as citizens for a policy direction. The critical success factors, which are significant in such approaches, include ensuring deal transparency, community empowerment, accountability, political commitment, inclusive governance, and, most of all, public legitimacy. This topic is covered in detail in *Journal Paper 2*.”

2.5.3 Deliberative Democracy Techniques Applicable in VC context

“The DD techniques recommended as suited to facilitate the VC based stakeholder engagement process by this research (*Journal Paper 2*) are selected from Hartz-Karp (2013) [p. 111–119] and are detailed below:”

(1). Consensus Forum: This is a popular deliberation process in aiding shared understanding and meeting consensus in a complex and challenging decision-making situation, where a variety of stakeholders namely, public, private, residential community, and civic societies are involved in making decisions. This technique is particularly useful when the participants are greater in number and representing divergent views on more complex issues, or most contentious issues as the approach and the consensus-based decision-making process.

(2). Multi-Criteria Analysis (MCA): The MCA technique is a structured iteration-based deliberation technique, leveraging scientific data and technology to help the decision-making process. This technique is a means of simplifying complex decision-making tasks, which may involve many stakeholders, a diversity of possible outcomes, and many, and sometimes intangible, criteria by which to assess the outcomes. This tool would help to prioritize a set of options identified with appropriate weights assigned, and rank them based on the pre-set deliberation objective.

(3). World Café: This technique offers a simple, effective, and flexible format for hosting large group dialogue using participatory rounds of shared interactions especially in joint visioning, planning, and designing to motivate networked exchanges in smaller group rounds. In this approach, participation is only by

invitation, based on the purpose of the meeting. World cafés can be used to enlighten a specific issue or multiple issues, where people engage in endless rounds of conversations ascertaining questions related to a particular problem in each cluster.

(4). 21st Century Town Meeting/Dialogue: This technique is a software-enhanced public deliberation forum with near real-time outputs and priorities generated. This technique is more useful to conduct with a large group deliberation and provides instant feedback. Participants are linked through online networked computers and engage in informed deliberation in smaller groups through real-time feedback and deliberation to find common themes and priorities on most contentious issues. This approach primarily seeks substantive feedback on the main topics, common ground, and to prioritize what is most important in influencing decision-making.

(5). Open Space Technology: The Open Space Technology meeting is to create time and space for people to engage deeply and creatively about issues of concern to them. Later, an open circle meeting is reconvened, where all participants can give their comments as part of a facilitated process. This technique is followed by a final plenary session where participants can provide comments and, finally, it provides the outcome with a common understanding of defined goals, actions, milestones, and responsibilities with a way forward.

(6). Local Area Forum: This technique is popular to bring together government, industry, and community to determine the optimal use of scant resources through coordinated actions and collaboration. It is more representative of the local community and can get greater local ownership of issues. In this method, the local community is more involved and empowered to make informed decisions on what the community requires.

(7). Strategic Questioning: This is a powerful problem-solving technique to engage groups in innovative thinking, to develop strategy, to facilitate change, and to gain

acceptance to new ideas. Strategic questioning as a tool helps to find creative ways in times of uncertainty, conflict, and confusion, and in case of current thinking, appears to be constrained.

The set of DD techniques provide a powerful and effective way for communities to engage and co-create more consensual policy decisions with communities, public sector decision-makers, and other "experts". The deployment of appropriate techniques will depend on the engagement objectives, such as understanding stakeholder expectations, assessing levels of participation interest, and other interconnected objectives (Margaret and Hartz-Karp, 2013).

2.6 Literature review summary

The reviewed global best practices envisage that “there is no one size fits all solution possible for urban rail financing through VC. The choice of an appropriate VC instrument influenced by several factors namely; the administrative ease of collection; legislation related challenges; socio-economic-demographic preferences; and political priorities. The applicability of a specific VC mechanism in one project may or may not be applicable in another project due to a number of factors such as location, legislation, project type, willingness-to-pay, ease of adaption, administration, duplicity, and these are all areas that need to be looked into on a case-by-case basis (*Journal Paper 1*).”

“The key take away from various VC best practices is that there is a considerable potential exist for VC based funding opportunity in India if it can be tapped with a strategic approach from the planning stage itself. The three essential stages of VC involve as value creation, value capturing and then value redistribution. Further, a bright, transparent, and inclusive implementation strategy is critical to the VC success. The stakeholders mainly, the beneficiary community and taxpayer community participation and involvement in structuring VC from planning to execution stages are crucial to VC success. The VC focus initiates by constructing a value analysis model which can then be translated into economic benefits with value monetization. Later deliberate and discuss on the allocation of the part of the monetized value to build rail transit systems and part of the fund for the development of station areas with inclusive value redistribution model. Then it is significant

to define the VC governance through the participatory institutional structure with accountability, checks and balances are in place to administer the fund (*Book Chapter 1*).”

“Further, a combination of active and passive VC mechanisms may work as a better approach to providing the best potential value proposition. It is also important in choosing the appropriate VC instrument to impress the people feel as partners to the VC initiative on a win-win basis and not as victims of such efforts. Further to maximize the VC based revenue flow, it is essential to align the transit system project with land use planning.”

Cities in developing countries are in need of guidance to formulate and implement a VC based financing model. Global practices confirmed that VC based funding mechanism could offset the funding requirement of urban rail projects for Indian cities but needed framework from planning to implementation stages

Overall, this research conducted a literature review in the context of the recently announced new metro rail policy of India mandating private investments to build urban rail. It therefore looked at what are the main approaches that can enable this through land value capture. It examined the concept, how it is measured and its various practices as well as how they can fit within PPP delivery mechanisms. It also reviewed the significance of participatory approaches and how they can increase value outcomes. The next sections of the thesis can therefore examine the Bangalore case studies to ascertain how well the literature applies to Indian cities and other emerging cities.

3 RESEARCH METHODS

Figure 2 presented “the structure of the research and also illustrated linkages between research aims, the publications, the planning, policy, case study” based best practices review analysis and quantitative methods applied in the thesis.

Aim 1 is analyzed through multiple case study review analysis including ongoing practices and also global best practice secondary data source inputs, which identified the key challenges and opportunities for Indian cities and other emerging cities. The Aim1 findings are compiled in detail in *Journal Paper 1*.

Aim 2 focused on the quantification methodology of “economic willingness to pay for urban rail accessibility benefits”. The research demonstrated this method using a case of Bangalore Metro rail corridor. The majority of the quantitative methodologies used were involved with determining the impact on land values, and the subsequent willingness to pay methods are illustrated in detail in *Manuscript 2*.

The following Aims three, four and five focused on process-oriented solution framework recommendations. The frameworks and the results presented in several papers were developed from the findings and associated literature as well as the author's professional association with the United Nations ESCAP policy implementation and capacities strengthening projects which have developed practical guidelines in all this research approach (e.g., Suzuki et al., 2013, 2015). These are published in *Book Chapter 1, Journal Paper 2 and Manuscript 2*.

One further element of methodology is outlined in *Journal Paper 2* where the research project created a link between deliberative democracy and value capture-based rail development. The paper shows how the research developed a PSVC framework methodology using deliberative democracy applied to participatory stakeholder engagement in defining the VC process. This research demonstrated the PSVC framework applicable to a deliberative democracy dialogue using the case of Bangalore Sub-urban rail financing through value capture. It is also briefly outlined in this section.

This section starts with examining the methodology for estimating land value impact through a case study application using the Bangalore metro rail corridor. This study involves the approach for a corridor level study, selecting the influencing data parameters, data collection, and methodology with econometric modelling. This section also outlines the approach of deliberative democracy dialogue conducted using deliberation techniques adopted in the research.

3.1 Methodology for Estimating Urban Rail Impact on Land Values

The quantitative analysis in *Manuscript 2* presented the urban rail impact on land value uplift and assessed the willingness to pay along the Bangalore Metro Rail transit to Reach-1 corridor, a 6.3km stretch with six stations, as the case study area. The principal motive behind the understanding of urban rail impact on land values is to evaluate the extent of the increased land values resulting from rail interventions and to measure the “people's willingness to pay for the rail transit.” Such analysis is critical to VC implementation. Relevant theory and practice was discussed as part of *Manuscript 2* literature review in detail.

This research was conducted at a corridor level impact assessment. The key methodology flow involved at a corridor level study are: First, defining and delineating transit influencing area and proximity parameters. Second, identifying the data attributes and data sources. Third, analyzing data using econometric modelling techniques. Each step is explained in detail demonstrating the methodology using the case of Bangalore Metro study corridor application in *Manuscript 2*.

The scope of this study is limited to land value uplift analysis only, rather than property market analysis including residential and commercial properties. The methodology applied can be used later to assess the impact on residential, commercial property values and rental values as well. Unlike developed countries, the collection of land values data has huge database challenges in developing countries concerning availability, reliability and comparability.

3.1.1. Land value database challenge and how this was tackled in this study?

In India, getting actual land value data across a time series is a big problem due to the reliability of data sources and also on the format of the data availability. Not all the sources of data are

comparable on a common baseline. The demographic census data is decadal; the GIS data is available at different distinct time zones, population and densities on different wards. Land values are on a street or village or area based unit measure.

Typically, the Department of Stamps and Registration authority of the State Government publishes guidance land values as reference values, popularly known as circle rates. These data are grossly lower than the actual market transaction prices for various reasons. The Pilot data checks conducted in this research indicated that largely the prescribed guidance values are ranges from 1.5 times to 3.5 times lower than actual market transaction values. These guidance land values are updated on a regular bi-annual basis but in some states such updates not happened since last 3 to 4 years due to various reasons. Few states including Government of Karnataka of late amended the guidance values closer to market value. This research observed with a smaller gap in later years of data since 2012 and a huge gap of over three times in the early years of evidence since 1998.

The presence of any data biases was removed by this research with data consistency checks and data cleansing techniques. Applied by comparing the guidance value data with other data sources namely: land valuation data, Land auction data, bank loan data records, land acquisition costs paid by transit, and other published real-estate prices obtained from various secondary data sources. Accordingly, a data correction index was estimated and applied to the guidance values to ensure a fair market value price. Later a data sense-check was implemented with validations done with CREDAI¹ Bangalore city members and local users as part of a stakeholder survey and interviews.

3.1.2. Delineation of transit influencing area

The details of the how the delineation of the study area is done is explained through the Bangalore case study below and also described in detail in *Manuscript 1*. To assess the impact of the Metro on this corridor, firstly we have to identify and delineate the transit influence area. Considering

¹ Confederation of Real Estate Developers' Associations of India,

the literature review findings and also based on a site visit validation, a 1km stretch on either side of the corridor classified has been defined as the Metro impact zone. To help study the micro level influence of station proximity levels, selected the 1km radius was further classified into three subsets of binary distance bands as 0-250m, 250m-500m, and 500m-1000m. The proximity of buffer zones is explained from the perspectives of walkability and cycling convenience distances. The study area influence zone and binary range bands are mapped using ArcGIS base map overlays on Google earth maps on the Reach-1 corridor as shown in Figure-4.

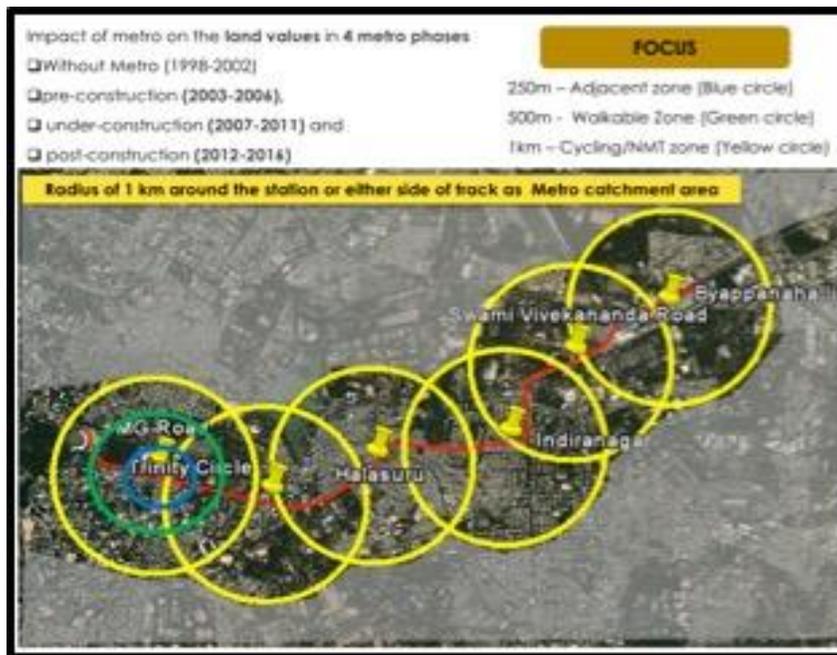


Figure 4: Study Area Delineation with Google Earth Overlay Map (not to scale)

As each station is roughly 1km distant apart, there is an overlapping area between two station catchment areas and again based on the nearest station location criteria, respective data are assigned to the respective station catchment area.

3.1.3. Data attributes identification and data size

Land values are the dependent variable in this study. Overall a total of 1200 land price data records covering the 2km stretch of metro influence zone was collected for the years 1998 to 2016. The

mean land values data of 288 datasets were used for panel data analysis. Also, for qualitative attributes, a representative stakeholder² Survey of 200 samples based on stakeholder perceptions was compiled with a weighted score index. These explanatory variables are listed in Table 1.

Table 1: Explanatory Data Variables

Station Proximity	Project status	Accessibility measure	Qualitative variables
Less than 250m 250m-500 500m – 1000m	1998-02 Without metro 2003-06 Metro Planning 2007-11 Construction 2012-2016 Metro Operation	Distance to CBD PT Index Walkability index Others Population Density	Multiplicity of use Travel time savings with Metro Peak Hour Traffic Congestion Current development Residential Potential Commercial Potential Mixed-use development Redevelopment potential
Land Value Data per Sq.ft or SQ.m used as Dependent variable			
Note: The year 1998, Station 1, and Station proximity buffer zone within 250m are considered as base reference data for the analysis.			

In order to address these complex data variables a spatial (cross-sectional) and a temporal (panel data) least squares regression based econometric methods were employed in this research.

“The econometric evaluation based on least squares regression is useful in investigating the interactions among diverse explanatory variables against a dependent variable. The understanding of the quantitative relationships between a “city's function, form and willingness to pay for urban

² The stakeholder group including; real estate developer associations (CREDAI), residents, government sources, and metro passengers.

transit” was exceedingly beneficial in the development of the urban transit value capture framework.”

3.1.4. Econometric modelling: HPM Cross-Sectional and Panel Data Analysis

The data were analyzed concerning land value uplift through temporal and spatial variations. Land value changes were examined in comparison with accessibility, density changes and station proximity over a time series. The HPM regression was conducted with cross-sectional and longitudinal analysis.

“Spatial (cross-sectional) least squares involves application of Least Squares regression analysis, where the relationship between the dependent variable and explanatory variables is expected to be linear.”

“The parametric equation for the observed land price (P) is shown in Equation 1. ”

Equation 1 Parametric Land Price Equation

$$P_i = f(X_j; \beta_j) + \varepsilon_i$$

Where:

- P_i “is the estimated land/property price of the i^{th} observation,”
- X_j “is a vector of quantitative and qualitative land/property attributes,”
- β_j “is the unknown hedonic, or implicit price, of the land/property for attribute j, and”
- ε_i “is the stochastic error.”

Hedonic price model (OLS regression)

The first model used to quantify station distance's effect on land values and to disaggregate that effect into the four top effects listed below.

Equation 2 *Hedonic Regression Equation*

$$P = \alpha_0 + \alpha_Z Z + \beta_L L + \beta_C C + \beta_R R + \gamma PP$$

P is land value, C is Accessibility measure as distance to CBD (similarly PT index, Walkability index can be added), R is project status as planning, construction or operations, P is rail station proximity status within three defined levels, and Z and L are sets of other qualitative dummy variables. This study applied eight variables that are independent of rail station proximity. This study conducted a semi-log or log-log regression, along with a linear regression, to achieve better statistical results. The station proximity (P) is captured by a set of dummy variables for being less than 250m, between 250-500m, and 500m-1000m.

In this study, linear functional forms were used in the regression models. Four different regression types: “Linear, Log-Linear, Linear-Log, and Log-Log,” were trailed for cross-section analysis to define the right fit model that derives the transit impact. The summary of cross-sectional HPM data analysis with various regression functional forms are shown in Table 2.

Table 2 HPM Models Summary and Analysis of Variance (ANOVA) 2016

Model	Model Summary			ANOVA	
	Function	Adjusted-R ²	Standard Error of Regression	F value	Significance
Cross-sectional HPM	Linear	0.386	1634.56	52.74	0.000
	Linear-Log	0.376	1648.56	32.42	0.000
	Log-Linear	0.386	1634.56	51.37	0.000
	Log-Log	0.569	0.4425	86.67	0.000

Among them, the Log-Log model has maximum “Adjusted Coefficients of Determination (Adjusted-R²), and the smallest homoscedastic distribution of residuals matching the criteria for use in cross-sectional analysis.”

HPM Panel Data: Temporal Least Squares Regression

McIntosh et. al. (2014) states that “in general land prices vary over time and the panel data modelling in land prices would help understanding the behaviour of land prices over time. The most important reason for undertaking the panel data HPM analysis in this study was to determine

the changes in a city or region's land market hedonic prices before and during construction as well as after the commencement of operations of new transit infrastructure.”

A summary of Linear and Log-linear regression forms based on HPM panel data analysis with the new set of factor variables are given in Table 3.

Table 3 HPM Panel Data Model Summary and Analysis of Variance (ANOVA)

Model	Model Summary			ANOVA	
	Function	Adjusted-R ²	Standard Error of Regression	F value	Significance
Panel Data HPM	Linear	0.799	1128.248	51.874	0.000
	Log-Linear	0.920	0.4425	120.67	0.000

The results of the regression model demonstrated a significance level below 0.05. ANOVA results with 0.000 significance level and adjusted R2 of about 92% explanation for all the different regression models confirm that the Log-Linear model is a good fit.

The results of Ordinary Least Squares (OLS) HPM panel data and cross-sectional are provided in detail in Manuscript 2 and also discussed in the results section of the Exegesis.

3.1.5. Willingness to Pay Estimate (WTP)

“The desire to pay (WTP) for a parcel of land consisting of a range of site and neighbourhood characteristics can be calculated by evaluating the estimated regression variable and then taking the partial derivative of it concerning a feature of choice. In the case of an application of the log-log estimator “where the coefficients are approximating of the expected percentage change in land value, the WTP for a one unit change of an attribute can be estimated as in Equation 3 (Rosen, 1974).”

Equation 3

Willingness to Pay

$$WTP_{i,t} = \frac{d(P_t)}{d(x_{i,t})} \cdot \bar{P}_t = \beta_{i,t} \cdot \bar{P}_t$$

Where: \bar{P}_t “is the mean catchment land value in period t”

$x_{i,t}$ “is the regression coefficient of attribute I at period t”

A general WTP appraisal is given in *Manuscript 1*. The land value uplift percentages indicated the “people’s willingness to pay” for the transit. This case study demonstrated people willing to pay a premium for the transit proximity accessibility. Based on the case learnings, this research developed a Strategic Rail Impact Assessment (SRIA) as a simplified methodological framework to apply in Indian cities and other emerging cities as well.

3.2. Application of Deliberated Stakeholder Engagement to define VC process

This research conducted a deliberative democracy process dialogue demonstration using the PSVC framework detailed in *Journal Paper 2*, in a proposed Bangalore Suburban rail deliberation. This study is to demonstrate the PSVC framework “use in practice, particularly from the applicability to undertaking stakeholder engagement using DD techniques” in defining the VC process. The discussion focus was designed among others on “VC based Suburban rail financing through stakeholder engagement using DD techniques in Bangalore.” This DD application appears to be the first time DD has been used in defining the VC based financing process. This research used the “four-step PSVC framework” process this research: conducted the deliberation, identified the stakeholders, set the engagement objectives, selected engagement techniques and at the end monitored the engagement performance.

A variety of stakeholders were included in the deliberation: private sector (including hawkers), government agencies, landowners, and citizens groups. This deliberation deployed the DD technique 21st Century Dialogue and also Multi-Criteria Analysis which resulted in great debates and a consensus result that suggested greater equity and efficiency outcomes. “Participation also gave stakeholders an opportunity for social learning by hearing the views of other stakeholders, talking through the range of possible solutions, and in smaller groups consolidated constraints and opportunities. The major constraint collectively identified was that there is a lack of collaboration and coordination besides capacities between various agencies and are with many differing interests.” The deliberation results showed that better coordination was essential and a broad agreement was reached that VC potentially is on a win-win basis. The participants were clear that

DD based engagement offered them the opportunity to have their say. Therefore, the PSVC framework applied in the Bangalore case study has demonstrated its potentials for stakeholder engagement as a powerful tool in defining any VC based transit financing models with equity, efficiency and clarity.

4. OVERVIEW OF JOURNAL PAPER 1

“INNOVATIVE VALUE CAPTURE BASED RAIL TRANSIT FINANCING: AN OPPORTUNITY FOR EMERGING TRANSIT CITIES OF INDIA”

“Journal of Sustainable Urbanization, Planning, and Progress, vol.1(1): 56–65.”

Status: “Published Online June 2016 (<http://dx.doi.org/10.18063/JSUPP.2016.01.003>)”

Indian cities with over one-million population are mandated to implement “urban rail transit as a key driver” to address an array of urbanism challenges. This policy mandate led to trending an urban rail building boom with over 40 cities wants to implement new metro rail transit but are in need of funds. Currently, 10 metro lines in operation and seven others in construction stage already big expansion plans but want funds. Traditional funding or revenues models cannot sustain such huge capital investments beyond small portions of the network. Indian cities are facing a daunting funding challenge and looking for innovative financing options. “The use of land-based value capture (VC) mechanisms is gaining momentum across cities worldwide as a solution to transit funding and financing. The first cities in India are now deploying various VC based funding mechanisms but in a limited way.”

Journal Paper 1 reviewed “multiple VC based urban rail financing global best practices and assessed the first cities current VC practices and experiences. The review analysis summarized key challenges and potential opportunities to adopt VC as a mainstream funding source to build urban rail for Indian cities. This due diligence study primarily helped to define the way forward to this research. The study assessed **lack of knowledge and capacities** are the two chief barriers in mainstreaming the VC based financing to build urban rail in India.”

The key challenges and opportunities to adopt VC based financing to fund urban rail for Indian cities are summarized below:”

1. There is convincing evidence from the reviewed global practices that urban rail can be financed through mainstreaming VC mechanisms as an alternate funding source to build urban rail for Indian cities.
2. Indian cities have “kind of densities that are ideal for urban rail transit systems” and with huge untapped VC potential.
3. The current practices majorly “viewed VC mechanisms as only an additional tax based financing tool which has led to underutilization of the true VC potentials.”
4. Most of the currently implemented VC measures “do not cover the full costs of a transit system” as mostly they are only upfront one-off contributions.
5. FSI or FAR Premium sale are popularly used due to ease of application and to match narrow interests of developer lobby but may pose a danger to create haphazard high-rise developments as no other supportive investments in place.
6. A Huge windfall of unearned profits went into private gains of landowners or private developers who benefitted to a large extent by creating land banks along transit corridors.
7. No attempts made to involve the local community in the urban rail design or execution strategies due to current flawed funding and revenue models which offer a limited role for the local community.
8. “Many transit agencies at state and urban local bodies levels lack VC knowledge and skills nor have yet realized such significance as accessibility benefit.”
9. “If applied strategically the VC can be transformed as a potential financing mechanism, but risks and challenges involved in each project should be carefully analyzed and addressed upfront from the planning stage itself. A defined risk mitigation plan should be prepared upfront to ensure effective implementation. Such risks include unpredictable, volatile real-estate market, gentrification, zoning regulations, political interference, forward-looking leadership and unwillingness to pay for stakeholders, long gestation periods and revenue deficit, to name a few challenges. Accountability and collaborative institutional setup for the fund management and transparency in allocations and fund administration are also a key for VC success.”

“Overall, the VC practices in Indian cities are still at a nascent stage and are evolving. There exists huge untapped potential created by Indian urban rail boom. They are indeed looking for knowledge, guidance, capabilities and a framework to adopt VC approaches and strategies is the key conclusion of the study.”

Key takeaways to way forward direction:

“This study helps set directions to the research focus as below:”

1. Create a basic understanding of VC knowledge and best practices experience.
2. Create awareness on quantifying the urban rail accessibility driven value proposition with simplified methodology with implementation guidance.
3. “Many cities involved will have significant development benefits but need a guiding framework for VC delivery with a strategic approach from the planning to implementation.”
4. The stakeholders participation particularly involving, the beneficiary and taxpayer community in designing “VC from planning to execution stages is a key to VC success to keep lobby groups at bay.”
5. Enormous potential exists for the private sector and to adopt rail plus property development concepts like MTR Hong Kong and other cities experience, industry or developer lobby group can be turned into huge investor group. However, how to attract private investments remain a challenge and gap to be addressed.
6. “A combination of private and public capital, involving both active and passive VC mechanisms may work as the best approach to providing the highest potential value proposition.”

“Moreover, the review findings and lessons learned will help enhance the understanding of the challenges in other emerging transit cities of developing countries. The key takeaways apply to cities of developing countries context as well.”

5. OVERVIEW OF MANUSCRIPT 1

“CAN URBAN RAIL CATALYZE TRANSIT ORIENTED DEVELOPMENT WITH LAND VALUE UPLIFT? EVIDENCE FROM BANGALORE METRO”

Journal of Planning Education and Research

Status: Submitted on 16 Sep 2017 Manuscript ID: JPER-2017-172.

The research conducted in *Manuscript 1* is a unique contribution to the key takeaway point 2 identified in *Journal Paper 1* with a case demonstration on quantification of “Willingness to Pay” for the transit accessibility.

This research analyzed the impact of urban rail dynamics on land value uplift using the case of Bangalore city metro rail in India and at the same time to developed a methodology suitable for other emerging cities and perhaps developed cities that need a simplified methodology for land value capture. The relevant literature is reviewed specifically for its applicability and replicability in the context of emerging cities. The research was designed with HPM cross-sectional and panel data analysis across a time series to assess the land value uplift and also understand the willingness to pay for transit. The time-based variables follow the “pattern of dynamic land value changes impacted by transit across three phases: pre-transit, during construction and post operations.”

The principal motive behind the “understanding of transit impact on land values” is to try unlock the increased land values resulting due to rail interventions and to assess the “people's Willingness to Pay' for the transit.” WTP is critical to VC implementation as this determine or predict the value proposition due to the urban rail impact.

The available literature on urban rail transit impact studies is mostly from cities of the developed world. Though a major urban rail transit building boom is currently underway in the emerging cities of India, these are less studied for their transit drove impact assessment. This gap is perhaps because many cities in India while implementing urban rail have focused on supply and demand based approaches driven by fare box revenue models rather than seeing them as a major driver in

urban development (Jillella and Newman, 2016). This research will show that urban rail feasibility studies that only focus on predicting passenger demand and environmental impact based assessments are missing major economic considerations related to developmental impact and strategic planning as well as options for financing.

However, the assessment of transit driven accessibility-accrued value propositions is, particularly challenging. Unlike the cities of the developed world, the availability of reliable and organized land value data is a big challenge in many emerging cities. There exists a huge gap between data availability, consistency, and reliability. Another challenge is that not all the sources of data are comparable on a common baseline. Therefore, the available impact assessment methodologies cannot be directly applicable in many developing countries due to database challenges and limitations.

There is a need for a simplified, predictable, transit econometric value impact assessment methodology matching the data constraints of emerging cities. This research addressed this concern providing with unique case demonstration guidance.

Transit driven land value uplift was examined with time, station proximity, and distance to the city center using the hedonic price modelling (HPM) methodology. The HPM panel data analysis revealed wide-ranging Metro rail influence on land values across pre, during and after metro project phases. The HPM cross-sectional study determined that the people's willingness to pay be 25% to 42% more for transit proximity within a 1km station catchment area.

In this research, for the WTP assessment considered the distance band criteria for the analysis within 250m, 500m and less than 1000m from the station area considering the development characters and land values of the case study area. The current report is based on residential land values. In the present case study majority of the frontage plots up to 150m distance is purely commercial development. However, the proposed study methodology is flexible to choose different distance bands as required to conduct WTP analysis. The recommended Strategic Rail Impact Assessment (SRIA) model suggest various distance band combinations classified as 0-150m distance band as frontage plots, 150m-500m distance band as a walkable zone, 500m-1000m

distance band as cycling zone, 1000m-1500m and beyond distance bands as no influence zone of metro respectively. Several assessment combinations can be explored if there is a quality database available.

In order to understand with and without metro rail scenarios based WTP analysis are dealt in the current research using HPM cross-sectional analysis for any given year and HPM panel data analysis using a time series data for different periods classified as before or no metro phase, during the metro construction phase, and post metro operations phase-based analysis. The HPM panel data analysis showcased the land value impact of no metro rail period and also without metro line but proposed route alignment phase as well. The study found that there exists significant speculation in land values with route alignment finalization stage itself. However marginal stagnation noted during the construction phase, and again a considerable increase found during the operations phase.

In another parallel study of Sharma and Newman (2018) on Bangalore Metro residential property values using a real estate data of 898 condominium samples for the year, 2016 consists of with and without metro rail zones of similar characters are worth mentioning in the present context. In this study, both zones were compared with using HPM cross-sectional data analysis to calculate the WTP for the given the year 2016. The results of this study correlated that there exists a clear land value uplift happening around station catchment areas between 8% and 25% and also an overlay metro rail impact of about 4.5% value uplift across the whole city is noted. In this context, the WTP values can be classified as beneficiary willingness to pay within the station catchment area and also at the city level, people willingness to pay for public transport improvement in the city to assess the appropriate VC mechanism.

Detailed studies show the emergence of a polycentric city based on the Metro. This research suggests that a metro station-centered urban growth strategy is likely to work in India as suggested by similar studies around the world. Based on the key learnings from the case study, this research developed a simplified “Strategic Rail Impact Assessment” (SRIA) framework offering step-by-

step guidance to help assess transit impacts using a simplified methodology in the emerging cities context.

Conclusion: Research Highlights

1. The study results confirm that metro rail projects can catalyze significant developments along with an urban corridor as land value uplift is real and meaningful within a 1km radius of the metro station.
2. Overall the HPM cross-sectional and panel data modelling demonstrated people willing to pay a premium for station proximity.
3. The sprawling Bangalore polycentric trend has now possibly converged around metro stations promoting transit-centered growth potential.
4. The results suggest that Bangalore could use value capture mechanisms for extensions to the Metro as householders, business and developers are willing to pay more for premium density bonanzas introduced within the 500m station proximity.
5. The model of a sustainable multi-nodal transit city has emerged from Bangalore with application to any growing city.

By imparting knowledge on urban rail impact assessment, the *Manuscript 1* also contributed to the key takeaway point 1 of *Journal Paper 1* as well.

6. OVERVIEW OF BOOK CHAPTER 1

“EMERGING VALUE CAPTURE INNOVATIVE URBAN RAIL FUNDING AND FINANCING: A FRAMEWORK”

IGI Global ACIE Book Series – (ISSN;2326-6139): Book Chapter 6 (pp. 130-145)

“*Handbook of Research on Emerging Innovations in Rail Transportation Engineering* (pp. 130-145).” ACIE book series, “Hershey, PA: IGI Global. doi:10.4018/978-1-5225-0084-1.ch006.”

Status: Published May 2016

The research conducted in *Book Chapter 1* is addressed the chief concerns the key takeaway point 1 & 3 identified in *Journal Paper 1*. This *Book Chapter 1* “introduces the VC concept and provides global best practice. Further provided with a six-step Strategic Value Capture (SVC) framework to help define and deliver the VC funded urban rail transit implementation.”

“Recently, land-based value capture (VC) mechanisms have emerged as a pioneering solution to funding urban rail projects. The chapter provided with the understanding and rationale behind VC approaches through assessing the transit impacted accessibility value proposition and various VC mechanisms to capture the value created. This chapter first introduced the concept and rationale of a value capture based rail transit funding and financing approach, introduces various VC mechanisms, and then shares some of the global experiences from cities across North America, Australia, Africa and Asia regions in utilizing VC to fund urban rail. The chapter further elaborated on the various successful VC mechanisms suggested for value capture implementation towards achieving sustainable urban mobility goals, and also identifies future research requirements in this important area.”

“There is limited research available with regards to VC implementation, VC fund governance, and VC strategic deliverables, especially for urban rail transit in an emerging cities context but also in many places like Europe and Australia where the mechanism is not used yet. Therefore, this research addressed these limitations by introducing a six-step Strategic Value Capture (SVC)

framework. The SVC framework offers a platform for VC with step-by-step guidance VC implementation guidance to fund urban rail.” The six steps identified with VC process in SVC Framework are:

STRATEGIC VALUE CAPTURE (SVC) FRAMEWORK STEPS :

“Step 1: VC Initiation: VC Concept due diligence”

“This stage is more in a due diligence phase on VC and builds on the regular transport planning processes but adds in a much more defined land use element. A macro-level qualification of the project for VC based funding and financing would be done during this step. VC due diligence can be included as a pre-project VC assessment study along with project feasibility or detailed project report preparation stages. In the end, the following outcomes are expected:”

- Need for transit established through problem definition
- The best alignment with maximum anticipated VC potential is determined
- VC catchment area identified as influence zone
- VC stakeholders are identified
- VC macro level goals defined

“Step 2: VC Planning: VC Value proposition analysis”

“This step 2 is a key step in the VC project life cycle which validates the value proposition of the transit project. In the end, the following outcomes are expected:”

- Assessment of a willingness to pay assessment
- Assessment of active and passive VC potentials
- Validation of stakeholder participation
- Review the support infrastructure and station area planning

“Step 3: VC Design: VC Revenue capturing mechanisms”

“This step 3 is a critical phase in the process which focuses on how to translate the value created into monetary terms through appropriate VC mechanisms. This step identifies the revenue flows through various combinations of VC mechanisms.”

In the end, the following outcomes are expected:

- Passive and active revenue mechanisms with revenue generation plan finalized.
- Legislation challenges and ease of revenue capturing evaluated
- Stakeholders engaged in the finalization of the VC mechanisms and modalities
- VC fund prospects and revenue generation plan finalized.

“Step 4: VC Fund Strategy - VC Fund redistribution plan”

“This step 4 is a fascinating phase for planners, stakeholders and decision-makers as the VC fund redistribution strategies with stakeholder gain share model will be determined. Participatory budgeting practices can be explored to ensure more accountability, equity, and transparency in the decision-making. Once the strategies are finalized, then a detailed activity-based fund allocation plan could be determined. At the end, the following outcomes are” expected:

- Fund allocation strategies finalized and target beneficiaries identified
- Eligible projects plan with funding stages finalized
- Overall fund redistribution plan with multiple projects, objectives, and milestones detailed
- Participatory budgeting options explored

“Step 5: VC Implementation: VC Governance”

“Now that the value proposition has been assessed and the VC mechanisms to capture the revenues are identified, this step is about translating plans and strategies into action by creating a VC implementation mechanism. The following outcomes are expected:”

- VC institutional and administrative setup established
- Procurement process specified to enable private sector involvement
- Executive body with stakeholders’ representation formed including transparent budget allocation plan
- Stakeholder engagement and community empowerment plan.

“Step 6: VC Operations: VC Performance evaluation and monitoring”

“This step 6 is a VC sustaining phase. Once the various VC mechanisms, institutional and administrative setup is put in place, the focus turns to monitoring and evaluation with an established performance appraisal criteria and monitoring plan developed. This phase is an ongoing process. As an outcome of Step 6, periodical performance metrics of VC implementation and fund management will be published and actions to review.”

“The Six-Step SVC framework has been conceived on the principles of accountability and the utilization of a participatory approach. At the core of this framework is the goal of achieving sustainable mobility and sustainable development along the proposed rail transit corridor.”

7. OVERVIEW OF JOURNAL PAPER 2

“PARTICIPATORY SUSTAINABILITY APPROACH TO VALUE CAPTURE BASED URBAN RAIL FINANCING IN INDIA THROUGH DELIBERATED STAKEHOLDER ENGAGEMENT”

“*Journal of Sustainability* 7(7): 8091-8115. doi:10.3390/su7078091”

Status: Published June 2015 (<http://www.mdpi.com/2071-1050/7/7/8091>)

The research conducted in *Journal Paper 2* is addressed the key concern of the key takeaway point 4 identified in *Journal Paper 1* uniquely applying deliberated stakeholder participation approach to VC process.

“Often VC mechanisms are viewed only as a financing tool applied about increased land values from the administration and legislation perspectives, without actively involving the community in the process. The lack of such participation has resulted in the under collection of the true value established. The transit beneficiary community and city taxpayers were particularly important stakeholders in this process as their willingness to participate is critical to the overall VC success and transport outcome. Many successful community engagement experiences envisage that having the stakeholders engaged at the helm of policy-making process transforms them as an agent of change, and co-creator with the systematic pursuit of sustained collaboration.”

“Overall, the expected benefits from stakeholder engagement utilizing a participatory sustainability approach within a VC context include generating goodwill, removing uncertainty, and enabling equity, community expectations to be at the forefront of decisions amongst other benefits.” This research applied Deliberative Democracy (DD) techniques to the VC process to make the deliberation more efficient and productive. This research developed “a four-step Participatory Strategic Value Capture (PSVC) Framework offering a platform from which to undertake a stakeholder engagement process in VC based rail transit financing projects. The PSVC driven participatory approach to VC based project funding is to help improve trust, negotiation,

and dialogue between different stakeholders and to build broader ownership of the VC process with commitment.”

“PARTICIPATORY STRATEGIC VALUE CAPTURE (PSVC) FRAMEWORK:”

The “PSVC framework is comprised of a sequential four-step stakeholder engagement model” are described in detail as follows:

Step 1: Stakeholder Identification

“In a VC based transit financing project context, PSVC broadly classifies the stakeholders into three broad groups: investors, wind-fall beneficiaries, and city community. Understanding the aspirations and cross-sectoral objectives of these three stakeholder groups provide a solid platform to define the appropriate VC process to be undertaken. By involving these groups in the early stages of the project planning can also help validate the best transit alignment options and also elicit value proposition potentials through elevated or underground or at surface based transit operations. The details of each stakeholder group and their aspirations in VC context are described in detail in *Journal Paper 2*.”

Step 2: Set engagement objectives

“The second step involves defining the stakeholder engagement interventions and targets across all the six stages of VC life cycle. The initial stage is more a conceptual stage. Therefore, the set engagement objectives at this stage could include information sharing, communication of project goals, and the elicitation of the community views, the validation of the problem and determining the anticipated value addition through consultations. Similarly, stakeholder engagement objectives during the second, third and fourth phases would involve participation, deliberation, and co-creation from all groups as identified above and involves deliberating and agreeing on the various VC mechanisms to be utilized. The last two stages of VC life cycle drive the VC implementation and operationalization. During these last two VC stages, the set engagement interests are primarily collaboration, engagement, and empowerment through active participation in project steering groups and governance to ensure the set project objectives are achieved.”

Step 3: Select engagement techniques

“The third step facilitates the undertaking of stakeholder engagement by identifying appropriate engagement techniques that could be used across a VC life cycle. Primarily, this step focuses on establishing which engagement techniques might work best for each stage of the VC life cycle. DD techniques cross-referenced with VC life cycle and engagement objectives are provided in *Journal Paper 2*. Stakeholder engagement objective and the deliberation group size are the key consideration in choosing an appropriate technique.”

Step 4: Monitor engagement performance

“Step four involves reviewing the stakeholder engagement model undertaken and occurs after the process has started and is ongoing over the projects life cycle. A suggestive list of possible indicators of a process participation across VC life cycle within a PSVC framework is summarized in *Journal Paper 2*.”

The PSVC framework later demonstrated in the Bangalore urban rail deliberation, and the results indicate that the PSVC framework provides a powerful tool to envision the value of the project from all stakeholders. PSVC with DD techniques is a novel contribution to “VC based urban rail financing”, and can be applied to other cities globally.

“In conclusion, stakeholder-driven VC approaches can shape and reshape any transit-oriented development in compliance with sustainable development goals including community aspirations with well-defined value creation and value redistribution strategies up front.”

8. OVERVIEW OF MANUSCRIPT 2

“A VALUE CAPTURE DRIVEN RAIL CO-CREATION FRAMEWORK TO UNLOCK PUBLIC-PRIVATE PARTNERSHIP FOR URBAN RAIL IN EMERGING CITIES”

“Journal of Transportation Research Part A: Policy and Practice.”

Status: Submitted on 26 Sep 2017 Manuscript ID: TRA_2017_969

The research conducted in *Manuscript 2* is addressed the chief concerns the key takeaway point 4 & 5 identified in *Journal Paper 1* with VC drove private partnership uniquely on co-creation principles to shape a win-win collaboration as a new age Urban Rail PPP model.

Worldwide many cities have successfully tried out land development based PPP models to help meet the “financing gap for capital-intensive urban rail systems.” To this end, the Government of India on 16th August 2017 approved a new metro rail policy mandating the private investments among others to build the new urban rail. With the new strategic impetus for public-private partnership (PPP), the country has now entered an inflection point in the urban rail building. However, unlike other sectors like highways with toll revenue attractions, the private player's appetite toward capital-intensive urban rail system is said to be low due to higher risks and low returns. This PPP path is nevertheless not new to India, but less traveled and is still a burgeoning untapped story in railroads (Indian Express, 17 Aug 2017, ICRA Report, 2017).

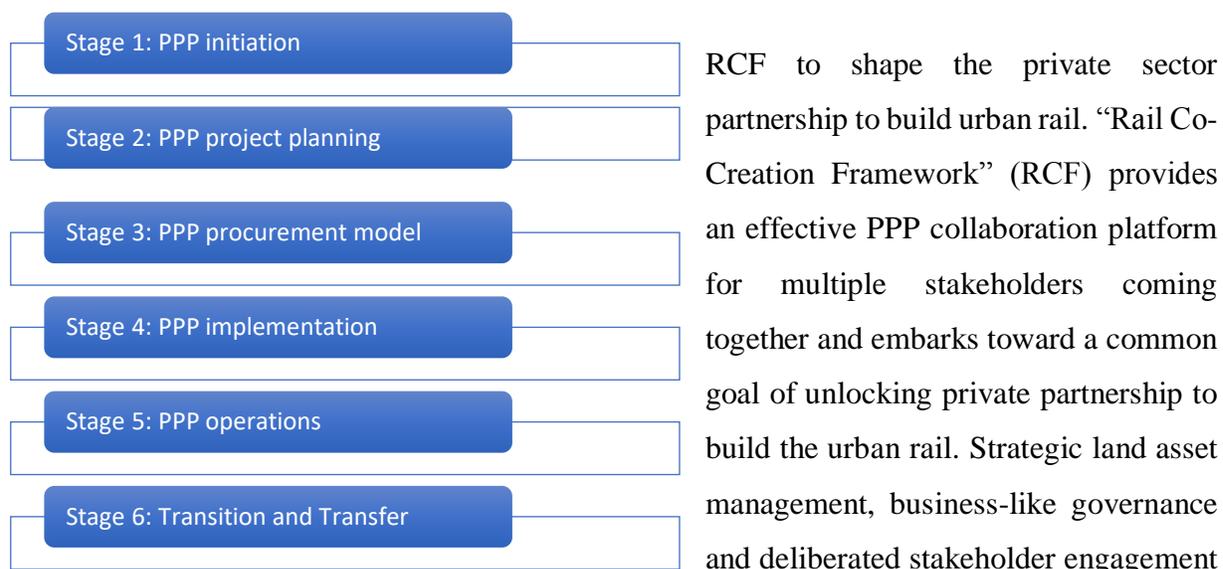
Presently there are only six rail-based PPP project initiatives, but few already got abandoned. The new metro policy is rekindling hopes for the PPP based urban rail. Notably, all of these piloted PPP urban rail models are very different from one another in design. The differentiated variety of each of the PPP engagements makes an interesting case to review seeking insight on what worked? Also, what not? This research, therefore, first reviewed these piloted PPP urban rail projects and selected global best practices for example MTR Hong Kong success to model it. Co-creation is rather new in VC process but more popular in customer experience creation.

Interestingly, the reviewed piloted PPP experiences envisage that no two PPP models are alike and no one size PPP solution suits all. The review confirms that piloted urban rail PPP experiences of Indian cities due to their variety offer many stories to tell and lessons to offer. Primary reasons for their failure are flawed revenue model, poor risk-sharing models and less valued time spent on partnership.

The typical PPP challenges include low patronage; high investment and low returns; bureaucratic inertia; one-upmanship attitude, rigid CAs, flawed risk-sharing, fiscal uncertainties, poor accountability; distressing administrative delays, land acquisition hurdles, and skewed procurement process are a few to mention. Manuscript 2 provided a detailed review of these experiences and summarized lessons to learn.

Establishing and delivering a winning PPP collaboration pose the real challenge. This research, therefore, developed an innovative project-level execution framework as shown in Figure 5.

Figure 5: Rail Co-creation Framework” (RCF)



Interestingly RCF conceived with entrepreneurial sprint with value built partnership model. The proposed RCF Co-Creation concept primarily thrives on seven virtues as Collaboration, Coordination, Creativity, Co-existence, Co-financing, Co-sharing and Collective wisdom. Contrary to the conventional top-down approach of PPP models, this proposed RCF

driven PPP focus on bottom-up approach with Inclusion, Integration, Innovation, Investments, and Incomes as essential philosophies to build urban rail. The key players are public, private and people in RCF collaboration model. In other words, as opposed to conventional 3 Ps model this framework employs 4 Ps partnership model as Public-Private-People Partnership model. The RCF provides a structured approach across the six stages of the PPP project life cycle from initiation to transitions as detailed below. The first two steps are majorly public-sector dependent to formulate the project with SPV governance model in place. Surely couple of engagement interventions and winning over the stakeholder group is critical to the project success during these stages. The procurement model is the very crucial stage of the PPP project life cycle. The fourth and fifth stage is focused mostly on contract administration, management, monitoring operations and performance evaluation. The last stage stated is in the context of transfer. This stage 6 again requiring a good transition, asset transfers, resource and knowledge transference to smooth takeover. The detailed co-creation process across each stage provided in Manuscript 2.

Further RCF integrated VC driven support with the PPP model to ensure revenue guarantees, improve patronage, built-in flexibility for unpredictability, accountable governance, and participatory approaches. In conclusion, RCF driven win-win PPP collaboration can co-create the urban rail with the value capture driven private investments. Thus, the proposed RCF guidance and reviewed lessons can be later applied to other emerging cities as well.

9. SUMMARY OF RESULTS

The qualitative and quantitative research analysis done as part of this thesis set out to establish the urban rail value proposition with VC potentials based on Bangalore. It then provided a set of frameworks and interventions to help in orchestrating a new financing system involving land-based 'strategic value capture' mechanisms to fund urban rail for Indian cities and to enable these results to be applied to other emerging cities. This section summarises the main results of this research.

Journal Paper 1 qualitative review analysis identified the key challenges and opportunities for the adoption of VC concepts within the Indian cities and emerging cities context. The study revealed that emerging cities lack knowledge and capacities on VC delivery which has led to under-utilization of the true potential offered by urban rail. The underlying success factor is that stakeholders are willing to pay provided they can be aware of the value proposition.

Manuscript 1 performed quantitative analysis using Bangalore Metro rail as case study applying hedonic pricing econometric modelling to determine the Metro rail value proposition. Transit driven land value uplift examined time, station proximity, and distance to the city center using hedonic price modelling (HPM) methodology. The study results confirm that Metro rail projects can catalyze developments around the corridor and also land value uplift within a 1km radius of the metro station is real and significant. Overall the HPM cross-sectional and panel data modelling demonstrated people willing to pay a premium for station proximity. The HPM cross-sectional study determined the people's willingness to pay 25% to 42% more for transit proximity within a radius of 1km station catchment area. The HPM panel data analysis revealed wide-ranging metro rail influence on land values across pre-, during, and -after metro project phases.

Figure 6 illustrates the pattern of land values change plotted across the time series between 1998 and 2016 covering all the pre-, during-, and after metro phases of selected Metro study corridors. The higher growth was between 2002-2006 as compared to 1998-2002. This period is the Metro planning phase with massive speculation and excitement propping up the price rise. The land prices are rather slightly lowered between the years 2007 and 2011 due to the hectic construction

activity in the city. Since the launch and post operations period of Reach-1 the Metro corridor showed a steep rise in the prices. These patterns of price change and the trend was better explained by plotting the Compound Annual Growth Rate (CAGR) comparisons illustrated in Figure 7.

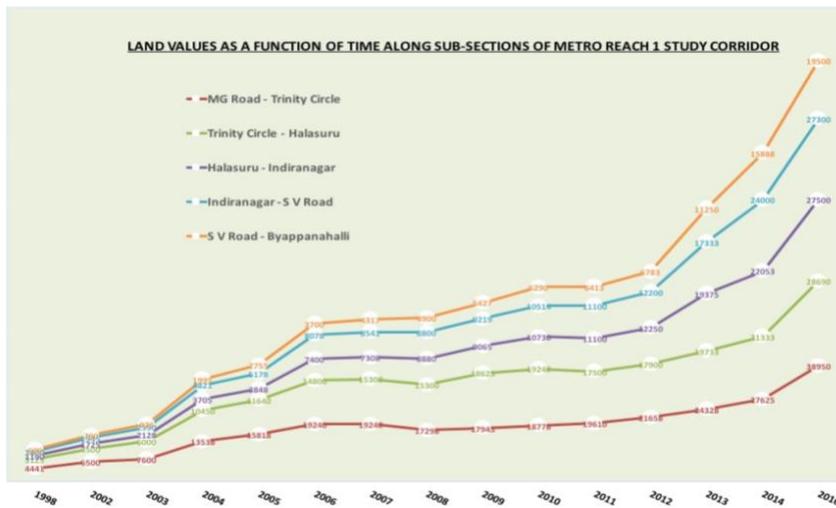


Figure 6 Land Values Change Pattern Over Time for Sub-sections of Metro Study Corridor

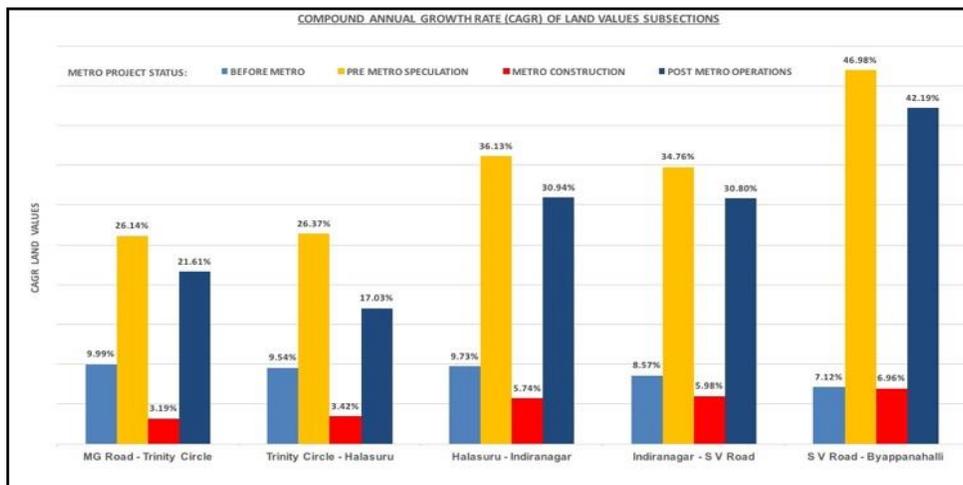


Figure 7: CAGR of Land values over different project implementation phases

Before Metro, the growth pattern is between 7% and 10% as a developing corridor. A huge surge in land prices during the Metro planning period showed a range of 25% to 50% across the stretch.

The Metro construction phase saw a dip in the land value prices with slower growth between 3% and 7% only. The attraction of Metro was seen again post the launch of the Reach-1 corridor with the growth rates range between 21% and 42% are noted. These are extraordinary values that indicate for Bangalore and perhaps most emerging cities with large traffic problems and big needs for economic development that there is a strong value case for more urban rail.

Traditionally land values also decrease when moving away from the CBD (AMM³ Model). Many of the Bangalore growth centers are now connected by Phase-1 metro network and a few others left will be linked to other phases. The current study plotted the land values against the Metro stations distance from the CBD area and revealed the fascinating finding and a strong result as illustrated in Figure 8.

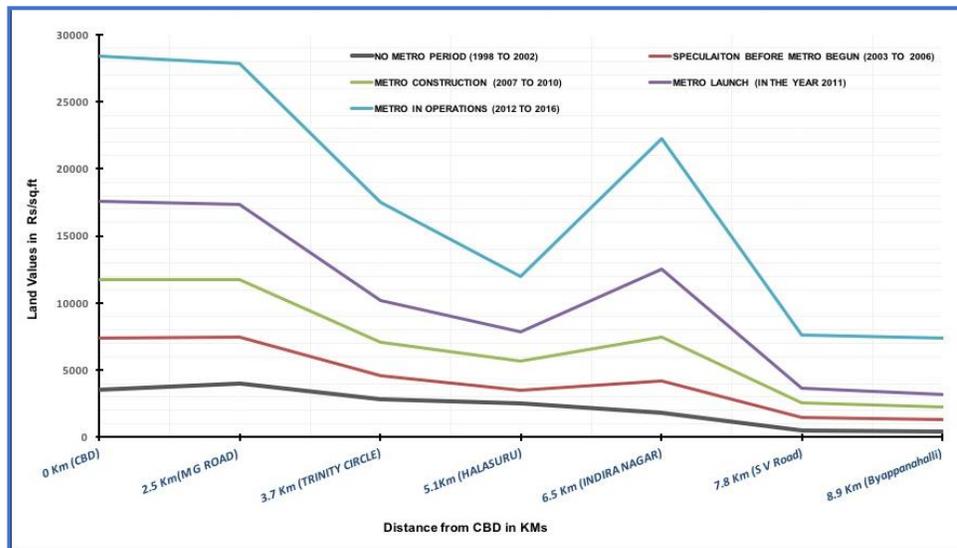


Figure 8: Comparison of Land Values concerning CBD

³ AMM – Alonso-Muth-Mills model, 1969

The impact of the Metro in one middle suburban TOD has growth rates in land value similar to those in the CBD. No other studies have revealed such extraordinary growth. Bangalore's polycentric trend reveals the potential for promoting transit-oriented growth potential in other parts of the city. The study results confirm that the Bangalore Metro rail project can catalyse TOD's around the rail corridor and also generate significant land value uplift with the potential to capture this for financing such rail building. Overall the results using HPM cross-sectional and panel data modelling vividly demonstrated that land value uplift due to urban rail around TOD station areas is substantial within 500m radius and it continues out to the 1000m radius.

The results show clearly that Bangalore would welcome anything that could further build urban rail and especially value capture mechanisms as they are willing to pay more for premium FAR 4 bonanzas introduced within 500m station proximity. The returns on investment of such projects are considerably higher given the fact that people are willing to pay a premium for accessibility to the Metro. If such a premium is shared up front or strategized to capture as Strategic Value Capture (SVC) (see Jillella, 2014), then the Namma Metro can, in fact, help to pay for itself.

Thus, in the next phases of the Metro, it is suggested that the planning and delivery of the Metro should now include Strategic Value Capture mechanisms using the Strategic Rail Impact Assessment Framework outlined in this paper to better fund the rail projects and create more TOD's.

Book Chapter 1 developed a VC framework from a review of best practices and deliberations as a six-step "Strategic VC" (SVC) framework offering a platform to formulate the land-based VC urban rail financing process covering the planning, implementation and operationalization stages involving stakeholders. Such a framework was designed to enable other Indian cities and emerging cities in general to learn from the experience in Bangalore.

Journal Paper 2 uniquely applied deliberative democracy (DD) techniques as a new approach in defining the VC delivery process. There does not appear to be any similar exercise in an emerging city. The research developed a four-step "Participatory Strategic Value Capture" (PSVC) framework using DD techniques for deliberated VC stakeholder engagement as an add-on to the

SVC platform. The PSVC framework was derived from a Bangalore metro rail deliberation. It confirmed that deliberated stakeholder engagement is a powerful tool to strengthen VC delivery with efficiency, equity and clarity.

Manuscript 2 performed case-study reviews of the six-piloted urban rail PPP project initiatives in India along with the MTR Hong Kong experience as global best practice. This provided valuable insight into how best to do PPP's. This review found that there is no dearth of Investors in India but what is needed is a viable financing model. This paper validated that Indian cities have a fit case to apply land development based PPP models but require an entrepreneurial approach to architect it.

10. CONCLUSIONS

The overarching research question this thesis sought to answer is:

“Does land-based strategic value capture enable the financing of urban rail for emerging cities like Indian cities, and if so, what mechanisms can assist in mainstreaming?”

To address the various aspects of this question, the thesis identified different research aims. How each research aim was addressed, and the conclusions that have been drawn from each, are summarised below:

1. Qualitatively review global best practice and to assess specific challenges and opportunities to implement VC funded urban rail financing for emerging cities like Indian cities.

Journal Paper 1 qualitatively examined and analysed the VC global best practice and assessed the ongoing VC practices of first Indian cities, confirmed that there exists a huge untapped VC potential created by Indian new urban rail boom. The Indian VC experience is at embryonic and still to be evolved. Indian cities are undergoing daunting funding challenge and need innovative alternative financing to build urban rail. Those introduced are one-off VC tax based mechanisms without any strategy but to generate a small portion of passive revenues underutilizing the true potential. This review summarizes the key challenges and opportunities for the adoption of VC concepts within the Indian cities context. The study revealed that cities lack of knowledge and capacities on the VC delivery aspects led them not to realize the full potential offered by the transit rail. The key takeaway is that “stakeholders are willing to pay provided they be aware of the value proposition.” Cities are needed guidance to formulate and implement VC based financing model. Global practices confirmed that VC based funding mechanism could offset the funding requirement of urban rail for Indian cities but needed guidance and framework to apply.

2. Analyse the economic willingness to pay for urban rail accessibility benefits building simplified econometric models for the Indian cities context.

The study results confirm that Metro rail projects can catalyse developments around the corridor and also land value uplift within a 1km radius of the Bangalore metro stations. Overall the HPM

cross-sectional and panel data modelling demonstrated people were willing to pay a premium for station proximity. The HPM cross-sectional study determined the people's willingness to pay 25% to 42% more for transit proximity within a radius of 1km station catchment area. The HPM panel data analysis revealed wide-ranging metro rail influence on land values across pre-, during-, and after- metro project phases at the high end of any comparative studies. Perhaps of even greater significance was the finding that a middle suburb TOD was able to attract high land value equivalent to the CBD. This would suggest that emerging cities would greatly value similar attempts to solve the problems of traffic and economic development.

3. Develop a strategic VC process framework to guide the delivery of VC-funded new urban rail for Indian cities and other emerging cities.

Based on the case study learnings, this research suggests that a metro station-centered urban growth strategy is likely to work in India and probably in other emerging cities. An eight-step strategic rail impact assessment (SRIA) framework has therefore been constructed offering step-by-step sequential guidance for any city but especially emerging cities with growth potential and traffic problems. The framework provides a macro-level impact assessment process flow explained in eight steps providing step-by-step sequential guidance. Hedonic cross-section data analysis with multiple checkpoints can yield the data required for decision making as such an approach is much faster and reliable at estimating the potential land value capture. Transit projects are highly capital intensive, and built over five years on average. Thus, a series of data collections are recommended for impact assessments starting from the planning phase.

Thus, in the next phases of the Metro and in any new urban rail projects in emerging cities, the Strategic Rail Impact Assessment Framework can be used to better fund the rail projects and create more TOD's that reduce traffic and help create more focused and knowledge economy-related jobs. On this basis, a six-step "Strategic VC" (SVC) framework was created (in *Book Chapter 1*) offering a platform to formulate the land-based VC urban rail financing process covering the planning, implementation and operationalization stages involving stakeholders.

4. Develop a stakeholder participation approach applying DD techniques to help define the VC process equitably and efficiently.

“The Six-Step SVC framework was conceived on the principles of accountability and the utilization of a participatory approach.” However, the approach needed a more community-based process to see if a more efficient and effective VC process could be created. The research therefore developed a “four-step Participatory Strategic Value Capture (PSVC) framework” using DD techniques for deliberated VC stakeholder engagement as an add-on to the SVC platform.

The beneficiary and community stakeholders participation in defining VC process from planning to execution stages are central to VC realization. As outlined in *Journal Paper 2* “a two-day deliberation workshop using deliberative democracy techniques, applying PSVC framework was trailed successfully in the planning stage of Bangalore sub-urban rail project context. The deliberations focused on local VC delivery process for the proposed Bangalore sub-urban rail project. The workshop results are therefore primarily evaluated based on the suggested indicators of the PSVC framework, stated in the initial and planning phases. Firstly, the workshop was a success in identifying and involving broad-based stakeholder groups, including the government, public, private, city community, sub-urban community, local governments, civic societies, and resident associations from the proposed sub-station neighborhoods. Secondly, the workshop deliberation achieved a consensus on the land-based VC financing for the project. Thirdly, the workshop deliberated on the barriers, and opportunities in the current system, along with high-level solutions is a good result in such a short time because of the DD techniques application. The second day identified actions, task-owners, and milestones for moving forward is a big success of the event.” The PSVC framework demonstrated in the Bangalore metro rail deliberation, confirmed that deliberated stakeholder engagement is a powerful tool to strengthen VC delivery with equity and clarity. This was a new research outcome and suggests that PSVC can be applied to cities across the globe.

5. Develop a framework applying co-creation principles to mainstream private investments to build VC based urban rail PPP project for Indian cities and other emerging cities.

The core conclusion from the above research is that cities will now need to seek ways of involving the private sector in their urban rail projects. This research, therefore, developed an innovative project-level execution framework as a Rail Co-Creation Framework (RCF) to shape private sector

partnerships to build urban rail. The RCF provides an opportunity for any emerging city to find an effective PPP collaboration platform for multiple stakeholders coming together seeking a common goal of unlocking private partnerships to build urban rail. Strategic land asset management, business-like governance and deliberated stakeholder engagement are core to the RCF approach. The RCF was conceived with an entrepreneurial spirit which is often not the case in value capture-based rail projects.

It is suggested that an RCF-integrated VC-driven based PPP model is more likely to ensure revenue guarantees, improve patronage, build-in flexibility for unpredictability, provide accountable governance, and enable participatory approaches. In conclusion, RCF driven win-win PPP collaboration can co-create the urban rail with the value capture driven private investments. Thus, the proposed RCF guidance and reviewed lessons should be applicable to other emerging cities as well.

11.RECOMMENDATIONS FOR FUTURE RESEARCH

The thesis identifies several research areas which merit further research. The research methods adopted in this research can guide future research on the identified areas, listed below.

Future research question 1

Can the assessment of land value capture potentials will help during the alternative analysis of transit route alignments and strategizing financing potentials?

Typically transit route alignment in general guided by the ridership potential obtained through transport demand modelling process as a common practice. Furthermore based on the projected ridership demand they choose the route between various alternatives present. In India, many times the ridership potential estimations projected during the feasibility study stage, are found to be highly inflated to get project approvals, politically gainful route choice and to showcase better FIRR. As a result, many farebox based revenue sharing PPP project ventures as detailed in *Manuscript 2* failed due to a massive shortfall from the projected demand. Therefore, as recommended in *Manuscript 2*, a further study on the VC potentials using the SRIA framework with WTP analysis could be integrated during an alternative analysis of route alignments as a more feasible approach. Such analysis even works well within any green field area too if the planners have development induced initiative either as a residential or commercial or tourism-centric intervention which will provide the needed ridership and VC potentials upfront to help attract private investments. Besides, assessing the VC potentials at an early stage will significantly help in strategizing the VC delivery and funding potentials using SVC framework as detailed in *Journal Paper 2*.

Future research question 2

Can the assessment of VC potentials from the city sustainable development perspective will help make an appropriate econometric urban transit modal choice for smaller towns?

Many Indian cities are irrespective of their size and demand opting for Metro rail projects with the aim to repeat Delhi Metro success. However, many smaller towns fail to justify ridership demands or can afford such highly capital intensive Metro rail projects from the ROI perspective. As a result, many smaller towns are not getting budgetary allocations and fail to attract private investments. Therefore, an early assessment of VC potentials quantifying the extent of transit impact in a city, followed by analyzing which urban rail modal choice generates sufficient value (demand – WTP) will generate a feasible econometric transit choice model for smaller towns. In fact, it is highly recommended to include VC assessment potentials study as per city sustainable development goals and financing perspectives and integrate with city development plan. A study using the Strategic Rail Impact Assessment (SRIA) framework developed in *Manuscript-1* could be applied to various urban transit modal choices to assess the value capture potentials across different urban transit modes like Metro, LRT, BRT, and Commuter Rail, to help make the right investment decision and in selecting right urban rail choices. Many first-tier Indian cities and also major metropolitan towns are having multiple urban transit systems in operation. Such comparative study will surely help to make the right transit investment choice and its VC based sustainable development financing strategies benefitting smaller towns in particular.

Future research question 3

Can a value capture based approach fund the urban centers of future TOD's and will Smart Code Zoning improve the VC potentials?

The methodology developed in Manuscript 1, and the SVC Framework suggested in Book Chapter 1 will help in assessing the potentials for future TOD's. If Smart code zoning like form-based-code (FBC) approaches are applied to these TOD's it may help expedite the transit-oriented developments. This approach may accelerate the developments faster than current practices of standard FAR-based zoning rules. Furthermore, sustainability goals can be incorporated and funded through smart code zoning, and thus the value capture process could add this dimension; it will make an interesting study.

Future research question 4

Does Deliberative Democracy work for Municipal Budget Allocations and Governance through participatory budgeting experiences in developing countries?

The methodology developed in Journal Paper 2, with the participatory sustainability approach and the PSVC framework possibly can be replicated into cross-sectoral research purposes by researching participation and budgetary governance through deliberative democracy processes. Participatory budgeting has been found to help achieve sustainability developmental goals (ref) and hence the use of the PVC Framework to create urban rail could be incorporated into the participatory budgeting menu of actions.

Future research question 5

Does a toolkit for decision-makers, planners, and executors on strategic VC planning, and delivery will help for urban infrastructure development financing?

Many emerging cities are embracing various initiatives toward achieving sustainable development but in need of guidance and financing. The rapid urbanization growth challenges burdening many cities for infrastructure investments on priority. The current thesis with a focus on urban rail transit infrastructure financing developed four frameworks (SRIA, SVC, PSVC, and RCF) and strategic interventions. At macro-level these frameworks will provide a step-by-step VC delivery guidance. These can be further applied to across various other sustainable infrastructure development needs and their financing. However emerging cities are in need of guidance, resources, and capacities. The over-reliance on budgetary grants, fare-box revenues, debits, administrative delays in getting approvals from a host of different agencies, rigidity of the contract agreement, no clarity on partnership obligations are the significant issues among others in many cities for infrastructure development. Lack of understanding VC potentials and guidance on adoption of VC financing strategies undervalues and underestimates the investment potentials in delivering urban infrastructure. Therefore, development of a toolkit for decision-makers, planners, and executors on strategic VC planning, delivery and governance aspects with action details and tasks will

significantly help to enhance the capabilities for emerging cities of the developing countries in particular.

Future research question 6

Will the Co-creation process with Private Sector involvement through land-based VC approach will make it fair transit opportunity with zero fares?

Manuscript 2 introduced the co-creation process and also the Rail Co-Creation Framework leveraging the partnership process to create multiple goals. As the results were so dramatic in enabling economic development it raises the question as to whether further subsidies could be given to encourage urban rail and TOD economic activity. It is suggested that a study could be done to reverse the traditional revenue model by making expensive, capital-intensive urban rail tickets free to improve densities and increase revenues through even more development opportunities.

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APPENDIX: RESEARCH PAPERS

Journal Paper 1: Innovative value capture based rail transit financing: an opportunity for emerging transit cities of India

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Jillella, S: (PhD Candidate) (85% Contribution)

Writing and completion of manuscript, established methodology, data analysis, preparation of tables and figures.



Satya Sai Kumar Jillella, PhD Candidate

Newman, P: (Principle Supervisor) (15% Contribution)

Supervised and assisted with manuscript compilation, editing and co-authorship of manuscript.



Professor Peter Newman, Principle Supervisor

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JOURNAL PAPER 1: VC CHALLENGES & OPPORTUNITIES

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RESEARCH ARTICLE

Innovative value capture based rail transit financing: an opportunity for emerging transit cities of India

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Abstract: Emerging cities of the 21st century are attempting to build rail transit as a key driver to maintain their city's competitiveness and help catalyze livable and sustainable development opportunities around station areas. Indian cities are doing this in a big way with about 50 cities embracing urban metro rail transit systems. The rail projects are ap-proved politically but need financing to build such highly capital-intensive rail transit systems. The use of value capture (VC) mechanisms is gaining momentum across cities worldwide as a solution to transit funding and financing. The first cities in India are now deploying various VC based financing mechanisms. This paper therefore aims to review the experiences of VC based innovative financing practices in selected Indian cities. The research summarizes the key issues and lessons learned from these experiences to help define the way forward. The paper finally concludes that VC practices in India are still at an embryonic stage but the results are encouraging with huge untapped potential to co-create rail transit centered sustainable growth. Moreover, the review findings and lessons learned will help enhance the under-standing of the challenges in emerging transit cities of developing countries.

Keywords: unlocking land values, value capture, transit cities, Indian cities, land use, rail transit funding, metro rail, urban rail, active VC mechanisms, passive VC mechanisms

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1. Introduction

Most emerging cities of the 21st century in developing countries are poised for accelerated growth and have the kind of densities that are ideal for transit systems. Many are thus con-templating rail transit-driven sustainable urban mobility solutions as one of the key drivers to address a range of urbanization challenges. There is a growing recognition among cities across developed and developing nations that urban rail transit system is a key driver to maintain any city's economic competitiveness and helps catalyze

livable and sustainable communities around station areas^[1]. Transit Oriented Development (ToD) options are designed globally to integrate rail with built environment, energy, economy and other transportation services in a way that ad-dresses sustainable city development goals^[2].

There is a second urban rail revolution trending across the world. Newman *et al.*^[3,4] noted that the 'trend back to rail' is perhaps to be expected in relatively dense cities and countries in Europe, the Middle-East and Asia. However, perhaps the more surprising trends have been in the US, Canada and

Australia, where traditional car-dependent cities that were once only considered suitable for bus transit in their suburbs are now seeing a future based around rail^[3–5].

Indian cities, following the global trend, are now rapidly embracing urban metro rail transit systems in a big way. For example, in India, the current urban rail (metro) is operational in 7 Indian cities, with another 9 cities currently constructing metros and a further 14 cities with rail transit in the planning stage. A further 16 cities have rail transit under initiation and eight regional rail corridors from Delhi are also being planned^[5–7].

As these urban rail projects are highly capital intensive projects, most city governments cannot provide the funding for such transit systems and largely depend on grants from state or central governments or on borrowings to create new urban infrastructure with limited success^[8]. This is a problem worldwide leading to the question of “how can urban rail transit systems be funded and financed?”^[9]

Innovative financing mechanisms to build such projects and sustain them are being sought around the world. A new approach to financing urban rail infrastructure is needed as there has been a dramatic turnaround in rail’s fortunes globally as well as an increased awareness of its value to 21st century cities’ sustainability goals^[3].

In this context, monetization of urban land values through induced and activated land use change is gaining attention worldwide as a new revenue generation source. Through capturing the increased value in urban land due to improved accessibility from building rail transit infrastructure, cities are now discovering a new way to improve their capacity to find the finance for building the infrastructure. Facilitating rail transit based infrastructure investments through value capture is relatively new^[10]. It is not new to recognize the value of integrating transport and land use but the need to integrate these two with financing is relatively new, and is conceptually more challenging^[2,3, 11–13]. Studies in US and Australian cities indicate that proximity to transit often increases property values enough to offset all of the transit system capital costs captured through a portion of their incremental value^[12,14]. This has led many cities across the world, including Indian cities like Mumbai, Hyderabad, Ahmedabad and Bangalore, to attempt tapping urban land values as an alternate sources of revenue but with varied experience^[15].

This paper therefore reviews the Indian city practices of innovative financing mechanisms that have been implemented. They are examined from the perspective of their potential and their challenges. This paper further analyzes the key issues and lessons learned, after which it concludes with recommended ways forward. The lessons captured will provide a guiding platform for future VC based financing of emerging transit systems in developing countries.

2. Traditional Financing Practices for Urban Rail Transit

Traditionally, property tax and government owned land assets are creating an economic base for many city local governments. In India, typically, the general revenue sources for city local government include charges such as property taxes, amenities fees, scrutiny fees, subdivision fees, development charges, building permit fees, betterment charges, grants (water supply, sewerage, housing), and deposits, security deposits (building permissions/tender), as well as government grants and loans. These revenues are now grossly inadequate even to maintain the existing infrastructure, let alone have any funds left for creating new infrastructure. There is a big, growing gap between supply and demand, leading to delays in construction or in short, inadequate increments of network^[15].

Turning to the private sector for financing can only work with urban rail if there is a necessary return. Most rail systems, even the profitable ones in Japan and Hong Kong, cannot make such a return from the fare box. The only way to enable sufficient return is if the private sector can make a profit out of land around stations. A confluence of all these factors has prompted an urgent need to look for innovative funding and financing mechanisms through unlocking land values to build such projects and enable them to be sustained.

3. VC Through Unlocking Land Values for Urban Rail Transit

The main idea behind value capture is that urban rail will increase land values when it is built; this must be beyond what would happen anyway due to rising incomes and other economic activity. These increases in land values can be captured directly by the private sector or by various government mechanisms and put into a Transit Fund that can then be used to fund and raise finance for building and operating the rail system. Thus it can involve private sector financing (for

building, owning and operating) as well as government sources of funding and financing, which in all cases will require a mechanism to capture the value created as a first step in unlocking the finance.

Many studies have established the relationship between urban rail services, accessibility, and residential and commercial property values that are able to provide the basis for mechanisms that can capture some of this value as an alternative funding. Capturing the value in an acceptable, transparent and equitable way involves multiple methods and complex mechanisms. In fact, there is no one-size solution that fits all needs in financing a new rail project through VC. The applicability of a specific VC mechanism may or may not be applicable in another project due to a number of factors such as location, legislation, project type, willingness-to-pay, ease of adaptation, administration, duplicability and many more; these are all areas that need to be looked into on a case-by-case basis^[5].

The most important way to categorize VC is into passive and active VC mechanisms. Active VC revenue sources are mostly revenue flows from active intervention such as buying property or creating a special levy on the station precinct whereas passive VC revenue flows are more asset value dependent so funds come from tax based revenue flows without intervention to actively pursue the value directly^[6].

Active VC mechanisms can be collected directly by the consortium building the system or can be collected by government into a fund used to pay the consortium chosen to build the transit and land development. The revenue can be generated from government owned property or from private land where owners are brought into a profit sharing agreement with the consortium that has been chosen to build the system; all land owners will benefit from the transit accessibility-driven increased land values. The revenues can be accrued if governments either sell their land holdings or sell the development rights to the land holdings. In case of deep cut subway transit projects, the newly created underground space holdings around transit station area can yield more revenues through shopping or business activities as revealed in the case of subway projects of Hong Kong, SAR China, Japan and London. The public transport financing practiced by Mass Transit Railway Corporation (MTR) in Hong Kong SAR, China and the Japan Railway Construction Agency (JRCA), a public corporation of Japan Railway are good examples of this active and developmental based approach. Hong Kong's MTR co-developed the

sites along the transit corridors and above the transit station rather than selling those sites. In 1993, the corporation financed about 22% of operating cost of their transit system through property rental income. Similarly, the greater Tokyo's private railways have practiced transit value capture through development on an even grander scale, building massive new towns along rail-served corridors and cashing in on construction, retail and household service opportunities created by these investments^[6,16].

Other active VC mechanisms can include betterment tax, benefit area levies, infrastructure levies, parking levies, special assessment districts, developer contributions, density bonuses or sale of air rights. In Australia, the Gold Coast Transport Levy, which is collected across the whole of the Gold Coast municipal area, was used to help fund and operate a new light rail. The Transport Levy was able to provide the on-going costs of operation and was used to induce state and federal capital for building the system. A Public-Private Partnership (PPP) model was made feasible based on such active intervention to create a fund to be used for raising the finances^[6,17-19].

Passive VC mechanisms are mostly on private land where the revenue flow is focused through ad valorem tax instruments, namely capital gains tax, stamp duty tax, land tax, GST on land sales and any other land-based taxes. These will rise due to the increased accessibility from the urban rail service and will flow into various levels of government. It is scientifically estimated the increased flow of funding can be hypothecated into a Transit Fund and used to attract financing from banks involving various combinations of the private sector and government. Passive VC mechanisms still require government actions but not directly in the marketplace; they can therefore be more politically acceptable but only if the government can afford to raise the loans. They do require Treasury Departments to hypothecate revenues and this may impact on credit ratings^[6,17-19].

Both active and passive value capture can enable more significant private involvement in the urban rail projects. If private financing is being used it is possible to involve private consortia in a PPP where not only do they bid to build, own and operate the rail system but they can also do entrepreneurial land development as part of their bid^[20]. Thus a combination of active and passive mechanisms could all be used to create a government Transit Fund or to enable a chosen consortium to raise the funds themselves from

land development and operational income or a combination of the two mechanisms to raise the finance^[6].

Some of the land based VC mechanisms used to generate public revenue in developing and developed nations context are briefly highlighted below^[15,21]:

- ⑩ In Bogotá, betterment fees and contribution devalorización, had together contributed US\$1.0 billion from 1997–2007, and US\$1.1 billion has been planned for 2008–2015. This fund was used to finance improvement programmes for a city street and bridges. Beginning in 1997, municipalities were authorized to capture 30 to 50 per cent of the land value increments resulting directly from public investments in infrastructure or indirectly through planning and regulatory changes.
- ⑩ In Cape Town, the sale of Victoria and Albert Waterfront property by Transnet generated US\$1.0 billion in 2006 and was used to recapitalize Transnet and support its investment in core transportation infrastructure.
- ⑩ Hong Kong's Mass Transit Railway Corporation co-developed the sites along their transit corridors and above their transit stations rather than selling those sites. In 1993, the corporation financed about 22% of the operating cost of their transit system through property rental in-come. MTR Hong Kong derives a major pro-portion of its revenue from land through lease/sale of property with grant of densification and development rights.
- ⑩ France has established a public transport fund-ing system known as "Versement Transport (VT)". It is a specific tax paid by public or private companies that have more than 9 workers located within an area covering 10,000 inhabitant's that benefit from the transit. This levy cross-subsidies either operational costs or new transport infrastructure.
- ⑩ In Copenhagen the appreciated land value resulting from a metro rail line of 22 km has been unlocked through direct payments (10 per cent), real estate taxes (10 per cent), and operating profits from the metro (30 per cent)
- In the metropolitan region of Sydney, a betterment levy of 30 per cent was imposed on specified rural lands and the proceeds from the levy were earmarked for financing city improvements.
- ⑩ In many cities in the United States, development impact fees are an important instrument

for unlocking land value and are used to generate revenues for funding or recouping the costs of capital works or extensions of existing infrastructure attributable to new development.

- In Munich, use of a revenue model for land based VC is imposed on urban developers. If a developer is interested in obtaining the license to construct a neighborhood, first he has to obtain the land value from a real estate experts' panel. After the land has been rezoned and has started with construction, the land value will increase. The difference between those two values is a measure that local government organizations may claim, till 2/3rds of this change, as a source to provide public infrastructure.

Table 1 summarizes various VC mechanisms as compiled by McIntosh et al.[6,17] from various academic studies, and relevant secondary sources.

For India, a series of studies have been done to examine these mechanisms. For example, in Ahmedabad (2015)^[22] a research study reviewed the implemented metro rail transit systems since 1965 across 141 cities worldwide to see the popularity of VC implementation mechanisms. The study found that only 38 cities out of 141 cities reviewed have formally applied various land based VC mechanisms to raise non-fare box revenues. About 65% of those cases are from developing countries. Figure 1 below shows the data on popularly used VC instruments across these 38 cities including both passive and active VC mechanisms.

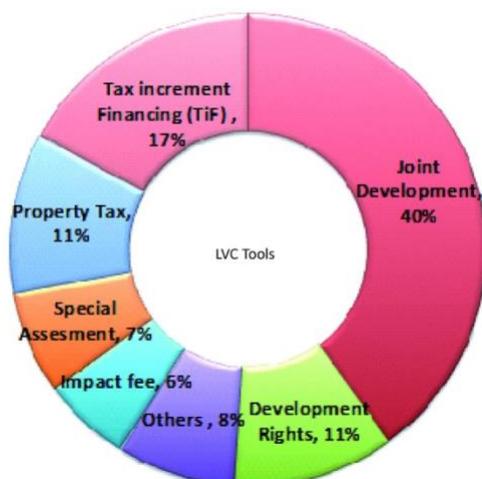
From the above various literature reviews, it is evident that there is no one VC solution that fits all as a predefined VC prescription but the use of joint development that directly funds a transit system out of the increased value in the land is by far the biggest mechanism. The underlying success factor is that stakeholders are willing to pay provided they are convinced about the value proposition. Prior to the implementation of the VC mechanisms listed, each mechanism should therefore be required to be evaluated against an existing policy evaluation framework and local conditions^[6].

4. Land Based VC Experiences in Indian Cities

Indian cities are building metro rail transit systems as multi-functional solution to a range of rapid urbanization challenges and mobility issues. The rail projects are approved politically but are in need of financing. Though it is a drive initiated by the Government of India,

Table 1. Compilation of VC mechanisms implementation from academic studies, and related websites (adapted from McIntosh *et al.*)^[6,17]

	VC mechanism	Implementation & Transit	Comments
Passive Government Property	Sale of surplus property/development rights/air rights	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) • Washington DC, USA (Metro) • Sydney, Australia (Heavy Rail) 	These VC instruments can be used when vacant public land or government property is available and got transit proximity asset value increase.
	Sale of naming rights to stations	<ul style="list-style-type: none"> • New York, USA • Philadelphia, USA 	
Active Government Property	Direct development of government property	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) 	These are more induced VC mechanisms and maximize the returns on the government land or property available and also own the asset value.
	Joint development	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) • Tokyo, Japan (Metro) • London, UK (Metro) 	
	Returns on public parking fee	<ul style="list-style-type: none"> • Portland, USA (Street car/LRT) 	
	Government property leasing	<ul style="list-style-type: none"> • Philadelphia, USA 	
Passive Non-Government Property	Advertising revenue at station areas	<ul style="list-style-type: none"> • Popular international practice 	Primarily focused on additional portion accrued due to increase in land values to the existing ad valorem taxes
	Tax increment financing	<ul style="list-style-type: none"> • Widely used in USA, UK & Australia 	
	State transfer duty/sales tax	<ul style="list-style-type: none"> • Atlanta, USA (Heavy Rail) • Dallas, USA (LRT) • Dallas, USA (LRT) • Portland, USA (Street car/LRT) 	
	State land/property tax	<ul style="list-style-type: none"> • Portland, USA (Street car/LRT) 	
Active Non-Governmental Property	Local government taxes	<ul style="list-style-type: none"> • Portland, USA (Street car/LRT) 	These are integrated transit and land use development oriented VC mechanisms.
	Special assessment districts	<ul style="list-style-type: none"> • London UK (Metro) • Seattle, USA (Streetcar/LRT) • Portland, USA (Streetcar/LRT) • Atlanta, USA (Heavy Rail) • Dallas, USA (LRT) 	
	Special area rates/service charges	<ul style="list-style-type: none"> • London UK (Metro) • Portland, USA (Streetcar) 	
	Infrastructure tax hypothecation	<ul style="list-style-type: none"> • Popular practice 	
	Developer contributions	<ul style="list-style-type: none"> • New York, USA (Metro) • Curitiba, Brazil 	
	Density bonuses	<ul style="list-style-type: none"> • San Francisco, USA 	
	Local parking levy	<ul style="list-style-type: none"> • San Francisco, USA 	

**Figure 1.** Popularly used land based VC mechanisms worldwide (adapted from Vivek *et al.*)^[22].

providing such capital infrastructure investments for burgeoning cities is a major financial challenge. According to the 12th Five Year Plan (2012–2017) draft Working Group report, it is estimated that Indian cities require investments to the tune of about

US\$58 billion. Therefore, many of them are heavily dependent on Central government subsidies and grants to build such systems. Recognizing the significance of raising finances, the Government of India envisaged through the National Urban Transport Policy (NUTP) of India, 2006 and further emphasized in the draft 12th Five Year Plan (2012–2017) of India, the need to raise finances through innovative alternate financing mechanisms. These principally include development of land and a land value capture mechanism with a focus on non-fare box revenues. The data in Figure 2 illustrate the share of non-fare box revenues generated as a percentage of total operating revenues across selected metro transit projects globally^[22].

Most new tram or train projects in the 19th century used land development as the direct basis for building their transit systems. Ahluwalia and Mohanty^[23] show that this was also the case in India. A number of developing countries are now following this course as part of the mix for capital financing of urban infrastructure projects. In the Asia region, Singapore, Hong Kong and Tokyo have all funded mass transit

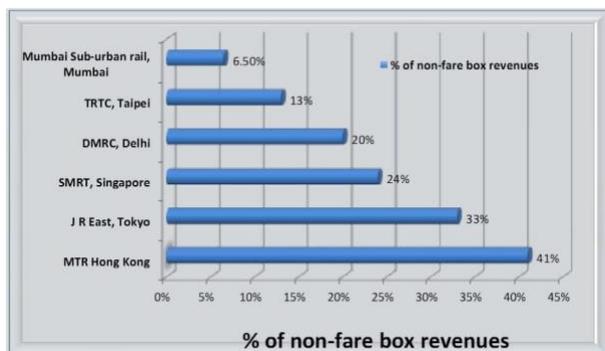


Figure 2. Percentage of non-fare box revenues earned by selected metros^[22].

Source: PWC Analysis Annual Report on Urban Rail in India, CEPT study^[22]

projects with private dollars based on the expected increases in property values. The following sections briefly highlight the examples of a few Indian cities that have begun to tap into urban land values as a way of financing urban rail.

Value capture in India has been used to finance urban infrastructure projects in the context of development of highways, especially ring road development, building rail transit systems, provision of civic amenities and affordable housing infrastructure projects. Table 2 below shows that land based VC mechanisms were adopted in five out of nine metro rail projects in

India^[5,15,23].

Some Indian states have made legislative amendments to enable urban local bodies to levy impact fees, premium FAR sales, and betterment charges. Many state governments have permitted the ULB to levy impact fees to mitigate the impacts of construction of commercial buildings that lead to increased traffic and necessitate decongestion measures. Such a fee is also levied for the sites abutting certain important potential

Table 2. Indian transit cities status on VC concept adoption

City/Metro rail	VC applied?
Delhi Metro	Yes
Bangalore Metro	Yes
Mumbai Metro	Yes
Ahmedabad Metro	Yes
Hyderabad Metro	Yes
Gurgaon Rapid Metro	No
Kolkata Metro	No
Jaipur Metro	No
Chennai Metro	No

Source: Compiled information from secondary data source^[5,15,23]

roads where the land values increase post road construction and demand for commercial activity will creep in. For example, the legislatures of states of Karnataka and Andhra Pradesh have enacted such VC instruments through an amendment to their existing legislation.

The Government of Andhra Pradesh has applied financing mechanisms to levy betterment charges originally through the Hyderabad Municipal Act, 1955. The Hyderabad Municipal Corporation has been using incentive zoning for the past 15–20 years with relaxation in planning norms including grants of Transferable Development Rights (TDR) for widening major roads. Greater Hyderabad Municipal Corporation le-vies an impact fee to generate resources for infra-structure development. A special development charge per square meter is levied on any development occurring within the 1 km growth corridor on both sides of the ring road. Hyderabad Municipal Corporation has employed a value capture mechanism based on cost recoupment via a betterment levy or special assessment tools for funding infrastructure needs to the extent of \$115 million^[15,21,23]. Likewise, a 300 m belt all along the metro rail corridor in Hyderabad is designated for multiple uses and an impact fee is levied per square foot of total built up area at the time of issuing the building permission. In addition, a city level infra-structure fee based on land use is levied across all buildings of more than 5 floors or 15 meters in height. Most of these levies are fixed as one time charges on spatial parameters like per square foot or square meter charges^[15].

Similarly, the Government of Karnataka made amendments to the Karnataka Town and Country Planning (KTCP) Act to enable capturing the land value through various methods like auctioning of sites, additional FAR, levy cess and surcharge, TDR and additional property tax in the catchment area of their Metro.

Bangalore's sale of excess land along the airport transport corridor generated US\$500 million as a part of a traditional public-private-partnership (PPP) to fund and finance the infrastructure^[21]. Section 18A of KTCP Act provision enables the collecting of a cess and surcharge for water supply, ring road, slum cess, and MRTS cess, with a maximum cap of 10% of market value. Section 20 of the KUDA Act 1987 provides the ability to charge a betterment tax in addition to a betterment levy. These levies direct funds to the accounts of public bodies like Bangalore Metro Rail Corporation Ltd. (BMRCL), Bangalore Development Authority (BDA) and

Bangalore Water Supply & Sewerage Board (BWSSB). For instance, under the KTCP act, levy of cess and surcharge at 5% of market value of land or building is charged to create a dedicated metro infrastructure fund. These revenues are shared by the metro transit agency BMRCL, BWSSB, and BDA at a proportion 65%, 20% and 15% respectively. In the last 5 years, the revenue received from 5% levy of market value is about Rs.1250 crores (equivalent to about US\$185 million)^[24].

Additionally, the Floor Area Ratio (FAR) values were raised to 4 from 2.5 within a 500 m distance along the Metro rail corridor and a levy cess of 10% of market value for residential and 20% market value for commercial on the additional FAR granted is charged. Bangalore accrued to the tune of about Rs.432 crores (equivalent to US\$63.5 million) in last 5 years from the cess on additional FAR granted. This again was shared across BMRCL, BWSSB, Bangalore Bruhat Mahanagara Palike (BBMP) and BDA at a proportion of 60%, 20%, 10% and 10% respectively.

The BMRCL also issues TDR (Transfer of Development Rights) to secure land for the metro rail alignment in lieu of compensation for the acquisition of land and private infrastructure bonds. Notably, Karnataka is the first state in India to impose the 5% cess on the guidance value of all new layouts. The collected amount has to be deposited into a Metro Infrastructure Fund (MIF) and from this pool the revenue is shared in the following ratio as BMRCL 45%, BDA 20%, BWSSB 20% and BBMP 15%. The amount collected is utilized for the provision of infrastructure in those new layout areas only. Thus new areas can be developed well before people move into new areas and thus make for a planned layout making provision for all civic utilities, pedestrian paths, cycle paths, as well as earmarking the metro alignment^[15,21,23,24].

Peterson and George (2009)^[21] report that shares from the Mumbai Metropolitan Regional Development Authority (MMRDA) auction of 13 hectares of land in Mumbai's financial center, generated US\$1.2 billion to fund and finance projects in the metropolitan transportation plan via the issue of municipal bonds. This revenue generated was 10 times its total capital spending in 2005–2006 and 3.5 times the total value of municipal bonds issued by all urban local bodies and local utilities in India during the decade 2001–2011. This clearly establishes the fact of VC potential in India.

Mumbai metro focus on advertisements and auction

the naming of stations; other non-fare box instruments include premium FAR, TDR and land sales. In Maharashtra state, Pimpri-Chinchwad city, FSI was increased from 1 to 1.8 along the BRTS alignment to raise resources. The proceeds were transferred to an Urban Transport Fund.

In the capital city, the Delhi Metro Rail Corporation (DMRC) has been mandated to incur an initial 7% cost of the project through property development, 30-year concession and long term lease for commercial development on vacant lands and development on vacant pockets respectively. Delhi Development Authority (DDA) is responsible for formulation of redevelopment schemes and modification of land use accordingly within the Delhi Metro “influence zone” (500 m). DDA also plans “Metro realty hubs”, the first project under a new Transit Oriented Development policy for Delhi. Real estate charges thereby are to be performed by the authority on any profitable projects which may return investments in a latter period^[25].

The Nagpur city Improvement Trust Act (1936) has the regulation of ‘Betterment Charging’, which provides a legislative framework to implement value capture mechanisms. However, the Nagpur local agencies have not been able to implement this regulation due to the absence of a holistic framework and robust implementation mechanism^[7].

Another VC practice includes land pooling through the town planning scheme that enables the best redevelopment potential around stations. This has been popularly practiced in the state of Gujarat. In such schemes, the government purchases agricultural plots on the city's periphery, constructs infrastructure, then sells the now richer land back to the former owner. The farmer gives a portion of the new value, as a betterment fee, then keeps or sells the remainder. Conceptually, this approach is a win-win for both parties and offers a way to uplift the urban poor. Town Planning Schemes (TPS) have been used to acquire undeveloped land in kind to build road infrastructure in Ahmedabad city which is within Gujarat state. Out of the total road length of 76.3 km of the outer ring road, 57 km were acquired through TPS. Core features of TPS include minimal displacement of people and the inclusion of self-financing, which enables everyone to benefit^[23].

5. Lessons Learned from Indian Cities VC Practices

Although it is a small start among Indian cities, the land based VC concept is still an evolving alternative.

The majority of the practices viewed VC mechanisms as only an additional tax financing tool which has led to underestimation and under-utilization of the true potentials offered by the momentous urban rail boom in India. The VC mechanisms are generally not highly regarded as they so far lack clarity, and are unable to develop a strategic VC perspective from planning to implementation stage of the project. The majority of VC practices introduced are only from fiscal policy or administration and legislative perspectives but lack beneficiary or stakeholder participation which is a key driver for VC success. Many of them lack clarity on redistribution of captured gains beyond sharing the funds. Most of the projects overlooked the necessary support investments for transit infrastructure integration and the urban design for sustainable community development aspects around station areas.

Some of the issues and key lessons are summarized below:

- Most of the VC mechanisms implemented do not cover the full costs of a transit system and are grossly inadequate to cover ongoing transit operations as mostly they are only upfront one-off contributions.
- No attempts seem to have been made to involve the transit beneficiary community or resident tax payer community in the VC process and its design.
- Few Indian cities try to tap the indirect benefits of a transit system due to lack of legislative powers, effective policies and skills.
- Many transit agencies and urban local bodies in Indian cities lack VC skills in house nor have yet realized such significance. Thus many cities in India are looking for guidance, framework and capability building in the VC implementation from planning to implementation stages.
- Most projects not followed any scientific VC assessment methods on fixation of amount of VC based tax. Majority fixed based on adhoc decision, earlier experiences, political acceptability and based on a consulting study input.
- There is no one size VC solution that suits all. Thus participatory approaches to VC involving the beneficiary community may yield good results as India's democratic processes are deeply embedded (refer to CUSP video[26]).
- Legislation may be needed for transit agencies to levy cess or define taxes.
- VC implementation calls for seamless coordination between multiple participating agencies involved and require a centralized nodal governance model with stakeholder representation and transparent operations.
- FSI sales or Premium FAR sale are popularly used across many cities. These however need to be regulated between civic agencies as the additional FAR means there is a need for additional civic infrastructure like fire stations, police stations, water and power requirements and street lights.
- Many sources of VC are still untapped in India — levies like vacant land charges, betterment levy, cess on new development, cess on fuel, parking taxes, congestion charges, auction based motor vehicle registration, quota systems.
- If applied strategically the VC can be transformed as a potential financing mechanism, but risks and challenges involved in each project should be carefully analyzed and addressed upfront from the planning stage itself. A clearly defined risk mitigation plan should be prepared upfront to ensure effective implementation. Such risks include unpredictable volatile real-estate market, gentrification, zoning regulations, political interference, forward looking leadership and unwillingness to pay by stakeholders, long gestation periods and revenue deficit, to name a few challenges.
- Accountability and collaborative institutional setup for the fund management and transparency in allocations and fund administration are also a key for VC success.

Overall, the VC practices in Indian cities are still at a nascent stage and are evolving. They are indeed looking for guidance, capabilities and a framework to adopt VC approaches and strategies.

6. Conclusion

Emerging transit cities if planned strategically with participatory VC based approaches can not only maximize their revenue potentials but can offer a tremendous opportunity to promote a sustainable development along the corridor. Smolka (2012)[27] highlighted that practicing successful implementation demands political resolution between local government and state government leaders, a fluid dialogue among fiscal,

planning, and judicial entities and management skills to deal with many complex factors and diverse stakeholders. The key conclusion from various VC best practices is that there is a huge potential that exists for a VC based funding opportunity in India and other emerging nations and cities. If it can be tapped with a strategic approach from the planning to implementation, the cities involved will have significant development benefits. The stakeholders, the beneficiary community and taxpayer community participation and involvement in structuring VC from planning to execution stages, is also crucial to VC success. However, if private sector funding is to be sought directly through land development opportunities it will be essential to involve private sector bids at an early stage to enable the best redevelopment options to be targeted. The way forward of the research is to develop a VC framework for the emerging transit cities, which offers a step-by-step guidance to help define the VC based urban rail transit funding and financing processes from VC planning to VC operations.

A combination of private and public capital, involving both active and passive VC mechanisms, may work as the best approach in providing the highest potential value proposition.

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Manuscript 1: Can Urban Rail Catalyze Transit-Oriented Growth with Land Value Uplift? Evidence from Bangalore Metro

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CAN URBAN RAIL CATALYZE TRANSIT ORIENTED DEVELOPMENT WITH LAND VALUE UPLIFT? EVIDENCE FROM BANGALORE METRO

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Abstract

Transit driven land value uplift in Bangalore shows the people's willingness to pay was 25% to 42% more for transit proximity within a 1km station catchment area. Perhaps more importantly an emerging TOD over 6km from the city center was shown to increase land value equal to that experienced in the CBD and inner area, from announcement through to completion, suggesting that a TOD strategy is likely to work in India. Thus, an eight-step strategic rail impact assessment framework was constructed offering step-by-step sequential guidance for any city but especially emerging cities with growth potential and traffic problems.

Research Highlights

1. The study results confirm that metro rail projects can catalyse significant TOD's along an urban corridor as land value uplift is real and significant within a 1km radius of the metro station.
2. Overall the HPM cross-sectional and panel data modelling demonstrated people willing to pay a premium for station proximity.
3. Bangalore can now pursue a polycentric TOD based growth strategy but should now attempt to use land value capture mechanisms to help pay for it.
4. A Strategic Rail Impact Framework provides the steps to create a sustainable multi-nodal TOD based city in Bangalore or any growing city.

1. Introduction

The cities of the 21st century from the developing world are investing heavily into urban rail transit as a solution to address urban mobility challenges, especially in China and India (Newman and Kenworthy, 2015). The available literature on urban rail transit impact studies is mostly from cities of the developed world. Mohammad et al. (2013) observed that lower land value uplift premiums were found in the car dependent North American and Australian cities compared to a higher premium in the transit focused, dense East Asian and European cities which have more patronage

and network for public transport. Though a major urban rail transit building boom is currently underway in the emerging cities of India with over 40 metro rail transit projects presently under implementation, these are less studied for their transit driven impact assessment. This gap is perhaps because many cities in India while implementing urban rail have focused on supply and demand based approaches driven by fare box revenue models rather than seeing them as a major driver in urban development (Jillella and Newman, 2016). This paper will show that urban rail feasibility studies that only focus on predicting passenger demand and environmental impact based assessments are missing major economic considerations related to Transit Oriented Development (TOD) potential and strategic planning as well as options for financing.

The principal motive behind the understanding of transit impact on land values is to unlock the increased land values resulting due to rail interventions and to assess the people's willingness to pay for the transit. Such strategic rail impact assessment study is even more significant when cities are looking at monetization of the increase in urban land values using land value capture mechanisms as a new funding source to build the urban rail (Jillella, Newman and Matan, 2015).

However, the assessment of transit driven accessibility-accrued value propositions is, particularly challenging. Land values can vary due to many other factors such as location, multi-modal presence, availability of networks, development concentration, density, property type, land use type and, of course, the assessment methodology used (Jillella et al. 2016, p.134). Unlike the cities of the developed world, the availability of reliable and organized land value data is a big challenge in many emerging cities. There exists a huge gap between data availability, consistency, and reliability. Another challenge is that not all the sources of data are comparable on a common baseline. Therefore, the available impact assessment methodologies cannot be directly applicable in many developing countries due to database challenges and limitations. There is a need for a simplified, predictable, transit econometric value impact assessment methodology matching the data constraints of emerging cities.

This paper is, therefore, attempting to analyze the impact of urban rail dynamics on land value uplift using the case of Bangalore city metro rail in India and at the same time to develop a methodology suitable for other emerging cities and perhaps developed cities that need a simplified methodology for land value capture as part of a TOD strategy.

Presently Bangalore metro is the second largest operational network in India next to Delhi metro. With the recent launch of its final underground section in Jun 2017, Bangalore Metro Phase-I network of 42.3km is completely operationalized. Bangalore Metro, also known as "Namma Metro" (meaning 'our Metro') constructed its Phase-1 network of 42.3km in nine reaches including two underground stretches. The first Reach-1 length of 6.3km section became operational in 2011 and is the scope of the current study to assess the impact of the metro on land values.

The relevant literature is reviewed specifically for its applicability and replicability in the context of emerging cities. The research was designed with Hedonic Price Modelling (HPM) for cross sectional and panel data analysis across a time series to assess the land value uplift and also understand the willingness to pay for transit. The time-based variables follow the pattern of

dynamic land value changes impacted by transit across three phases: pre-transit, during construction and post operations. The following sections of this paper discuss in detail relevant theory, methodology, the study criteria, the data sources and the definition and measurement of chosen predictor data variables. The results are reviewed further from the perspective of policy implications, emerging trends and future requirements. Based on the key learnings from the case study, this paper proposes a simplified “Strategic Rail Impact Assessment” (SRIA) framework offering step-by-step guidance to help create TOD’s by assessing transit impacts using a simplified methodology in the emerging cities context.

2. Urban Rail Impact on Land Values: A Brief Review of Theory and Practice

Though the land is immobile and not fungible its value is dynamically influenced by a set of different attributes namely: land characteristics, location, accessibility, proximity to facilities and civic services, quality of living space, time-based nature of development and land use. Furthermore, transit operational aspects namely the service frequency and extent of network, last mile connectivity, issues such as noise, pollution, and crime levels within the proximity of the station can also influence the land values (Diaz, 1999). Though the land price is a composite product of all these bundles of characteristics, regressing the price based on the various characteristics yield the marginal contribution of each feature.

There are several studies that have been undertaken to estimate the urban rail transit impact on land and property values in North America, Europe, and Australia. In more recent times accessibility impact is explained by the bid-rent theory, which views the price that the buyer is willing to pay for a particular property as a decreasing function of distance to a certain attraction due to certain benefits realized from the attraction (McIntosh et al., 2014). Landis et al. (1994) report that a nationwide survey conducted in the United Kingdom in April 2012 determined that within 500m proximity of a rail station properties are 9% higher than similar properties away from the line. He also showed that a similar study in Montreal in 2011 had property value increases of 13% within 500m of a metro station, 10% within 1 km and 5% within 1.5km. A study of San Francisco Bay Area found that for every meter a single-family home was closer to a Bay Area Rapid Transit station in 1990, its sales price increased by \$2.29 (Landis et al., 1994). Research in Perth, found an increase of 17% in residential land and over 50% in commercial property values around a suburban rail network. Also, a new fast rail service to the south increased residential land values 42% in a five-year period beyond those in similar areas (McIntosh et al. 2014). Another study conducted in 1993 on residential properties adjacent to the 14.5-mile urban rail in Philadelphia, USA, recommended that access to rail creates an average housing value premium of 6.4% (Voith, 1993).

Some studies have conducted time-series models to analyze the impacts during different phases of planning through to construction (eg McIntosh, et al, 2014). Such analysis helps to understand the speculative price increase possibility before construction, and price variations during construction and post operations. Mathur and Ferrel (2013) in their study on suburban transit-oriented developments found that transit price effects are significantly positive in the development and post operations periods.

Increasing accessibility through rail transit will inevitably influence development patterns and catalyze land use changes in the surrounding areas. The resulting TOD zones will have a larger impact on commercial land values than residential values, and the effect is reversed as the distance from the station increases. The increase in accessibility will inevitably improve pedestrian flows as well as local transport to support last mile connectivity; it will cause increases in densities as long as planning systems do not prevent this. Suzuki et al. (2015) summarized the land value increases with transit systems in developing nations for the World Bank signalling a significant shift in their commitment to mass transit due to the potential financial benefits that this produces as well as the possibilities for involving private investment.

Empirical studies typically use real estate sales transactions data across a wide range of development situations to elicit the amount that buyers are willing to pay for the individual features that make up the total price of a piece of real estate (Dubin, 1998). The different empirical methodologies used to assess the impact include the simple comparison and simple average methods, geographically weighted regression models (GWR), the difference in difference (DID) techniques and hedonic price methodologies (Mohammad et al. 2013). Among them, hedonic price models (HPM) are probably the most popular in these studies (McIntosh et al. 2014). The hedonic pricing method examines the relationship between land value and transport accessibility by standardizing many attributes in multiple regression models with the dependent variable as land value. The hedonic method is used to control the heterogeneous nature of properties when valuing the land. It decomposes the land price into its fundamental characteristics and obtains estimates of the value of each feature. The various data types used are cross-sectional data, and panel data with time series. Several studies have employed HPM methods to assess how much the people are willing to pay for urban rail transit accessibility and proximity among other factors by regressing the land value data. The regression models employed in previous studies used different functional forms of hedonic regression models: linear regression models, semi-log models, and log-log models, to explain more variance, and a greater likelihood of analysis. A linear function implies constant marginal implicit prices tenable in a situation of constant returns to scale in production. In nonlinear form, the cost of an additional unit of an attribute depends on the previous transaction as well (Goodman, 1998).

This paper focuses on applying the hedonic pricing method and time-series regression models analyzing the price contours around station proximity buffer zones using ARC GIS overlay methods.

3. Bangalore Urban Rail Transit: “NAMMA METRO”

Bangalore city is among the top 30 fastest-growing cities in the world according to JLL's Cities Momentum Index 2017 (JLL City Momentum Index, 2017). Bangalore with over 8.4 million population (2011 population census report) is only the third Indian city to opt for Metro rail transit after Kolkata and Delhi. Today, India has about 370km of Metro lines in operation, and about 520km are under construction, while many other cities are contemplating to build metro rail (Metrorail news, 2017). Now there are nine operational metro systems in India. Hyderabad Metro

Rail is scheduled to begin operations in 2017. Table 1 gives the details of nine operating Indian metro rail projects.

Table 4 (1) Operational Metro Rail Transit Projects in India (Metro rail news 2017)

City	Metro project	Date of Begin	Length in KM
Kolkata	Metro Rail	Oct 1984	27.39
Delhi & NCR ⁴	Delhi Metro	Dec 2002	217.90
Bangalore	Namma Metro	Oct 2011	42.30
Gurgaon	Rapid Metro	Nov 2013	11.60
Mumbai	Metro Rail	Jun 2014	11.40
Mumbai	Mono Rail	Feb 2014	9.0
Jaipur	Metro Rail	Jun 2015	9.60
Chennai	Metro Rail	Jun 2015	27.36
Kochi	Metro Rail	Jun 2017	13.30

3.1 Perspectives on Bangalore – a Sprawling City

Bangalore is well known as a hub for India's information technology industry sector. Besides the information technology sector, the high altitude of Bangalore with pleasant weather all year around, meant that the city became a favored destination for many manufacturing industries, public sector units, knowledge industry, research institutes, high technology labs, aviation, defense and biotechnology industry sectors. Population in the city grew at an annual growth rate of 4.7% during the decade of 2001-2011 from 4.3 million to 8.5 million; its population for the year 2021, assuming the same growth rate, is estimated to be 14 million.

The area of Bangalore has grown from 160 sq.km (1991) to 741 sq.km (2011), which would indicate the density of population fell from 251 per ha to 113 per ha. This density is still considerably higher than American and Australian cities which are mostly between 10 and 20 people per ha (Newman and Kenworthy, 2015). However, this large increase in the outward growth of Bangalore would suggest that it is related to the transport investments of the past 20 year period which has mostly been significant road investment. The built urban form has shown that the development of the major highways facilitated many scattered developments outside the central urban area. The urban form of Bangalore has grown spatially in a concentric manner and envisaged a radial growth pattern due to radial transport connectivity. The city has three layers of ring roads: Inner ring road, Outer ring road, and a newly proposed Peripheral ring road. The suburbanization trend with a decentralized growth pattern of the city is largely influenced by the setting up various industry hubs peripheral to the core city and improved road connectivity for these projects. The urban sprawl that followed was created through the availability of cheaper

⁴ NCR National Capital Region

land, jobs, and cost arbitrage, all related to better road connectivity from city to suburbs. A study by Sekar and Karuppanan (2012) study showed that Theil's Coefficient with population weighted density analysis identified that the Bangalore central area is losing population relative to suburban areas.

The subsequent growth of traffic in Bangalore has now created low travel speeds, high accident rates and increased vehicular pollution due to the rising use of private vehicles. The land use issues to do with sprawl are also recognized with loss of important green space (Bangalore Development Authority, 2017). The overcrowded buses with long routes are not able to cope with the major problems of city traffic and thus the city has recognized the need for an efficient rail-based transport system.

At the same time as recognizing the need for better transport the city has seen it needs more TOD's in the suburbs. They want to create a polycentric city and the new Metro system has been chosen because it can also enable more dense, mixed use sub centres or TOD's to be created. Overall, the Bangalore urban morphology is showing some decentralized polycentric characteristics but not in a uniform and guided pattern so development continues leading to a sprawling city eroding green buffer zones. Bangalore, like in many other emerging cities, has therefore invested into Metro rail transit as a way of solving transport and urban growth issues. Primarily Namma Metro is initiated as a sustainable mobility solution to Bangalore with objectives of reduced journey time, accident mitigation, reduced fuel usage, and lower pollution better as well as more focused land development (Arjith 2017, BMRCL DPR 2003).

3.2 Bangalore Metro Rail: Phase-1 Network

Bangalore Metro is planned with a network of 114 km operational length and with 101 stations connecting many growth centers of the city. It has been conceived to be built in phases. Currently, only Phase-1 has been completed and fully operationalized. There are another two more phases planned. The details of Phase-1 are presented in Table 2.

Table 5 (2): Namma Metro Phase-1 Network Details (Source: Namma Metro, Wikipedia, 2017)

Line	Elevated length (km)	Underground length (km)	Total length (km)	Stations
Purple Line	13.10	4.80	18.22	17
Green Line	20.20	4.00	24.20	24
Total	33.48	8.82	42.30	41
Rake interchange line	0	0.35	0.35	0
https://en.wikipedia.org/wiki/Namma_Metro				

The details of implementation are in Table 3.

Table 6 (3): Implementation Details of Bangalore Namma Metro Phase-1 Corridors

Section	Length (km)	Route		Open
Reach 1 (East)	6.7	Byappanahalli	M G Road	Oct 2011
Reach 2 (West)	6.4	Mysore Road	Magadi Road	Nov 2015
Underground UG2 (east to west)	4.8	M G Road	Magadi Road	Apr 2016
Reach 3 (north)	5.1	Sampige Road	Yeswanthpur	Mar 2014
Reach 3A (north)	4.8	Yeswanthpur	Peenya Industry	Mar 2014
Reach 3B (north)	2.5	Peenya Industry	Nagasandra	May 2015
Underground UG1 (north to south)	4.0	Sampige Road	National College	Jun 2017
Reach 4 (south)	4.1	National College	Vidyalaya Road	Jun 2017
Reach 4A (south)	3.9	Vidyalaya Road	Yelachenahalli	Jun 2017

Source: bmrc.co.in/Network.htm (accessed on May, 05 2015)

The various reaches of Metro Phase-1 are illustrated in Figure 1. Among the four reaches listed above, Reach-1 has been in operation since 2011. Therefore, to assess the impact of the Metro on land values and considering the limitation of time, budget and data availability, this stretch has been selected as a pilot study for impact analysis.

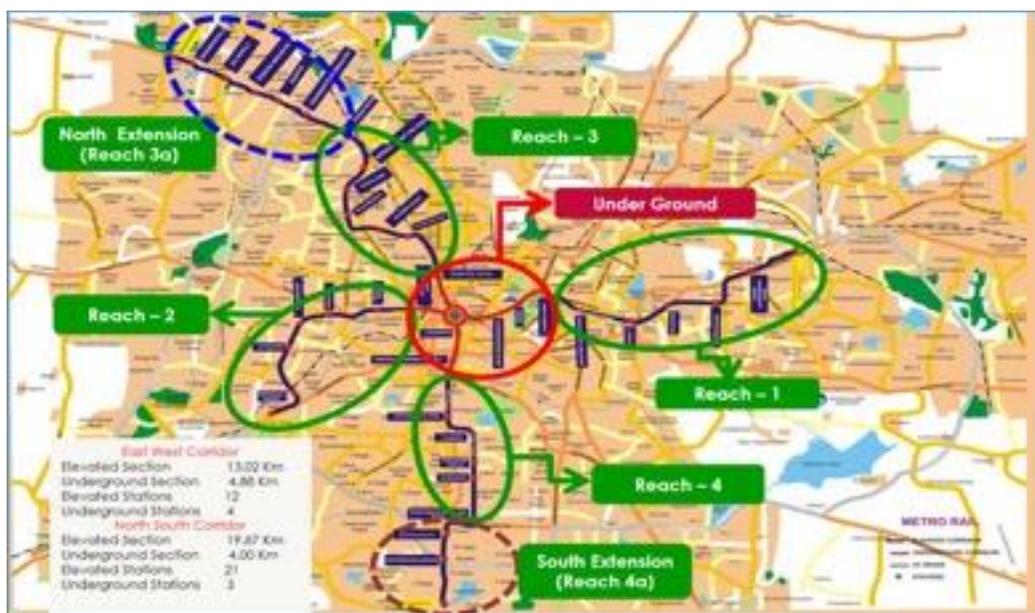


Figure 9: 1. Implementation Details of Bangalore Namma Metro Phase-1 Corridors

4. Case Study Area and Data

The scope of this study is limited to land values uplift analysis only rather than property market analysis including residential and commercial properties. The chosen Reach-1 study corridor of Namma Metro is the most prominent commercial corridor of the city and with high road connectivity with V/C ratios during peak hour traffic over 1.75 leading to severe congestion patterns (CTTP, 2007). All six stations are defined by their urban neighbourhoods but are different in terms of densities, development patterns, and land use split as given in Table 4.

Table 7 (4): Details of Station Land Use Characteristics, 2016

Reach -1 Station Name (Type)	Predominant Land use	0-500m	500m-1000m
Byappanahalli (Peripheral Urban Neighbourhood Station)	Industrial	Transportation and Industrial areas	Industrial areas, Residential (main), Apartments coming up
S.V.Road (Outer Urban Neighbourhood Station)	Public and Semi-Public	Public and Semi-Public Educational, Residential, Community shopping	Educational, Residential, Mixed Use, Apartments
Indira Nagar (Outer Urban Neighbourhood Station)	Residential	Commercial, Banks, Restaurants, Mixed residential, hotels, apartments	Villas, Houses, mixed-use Residential, Apartments, high density residential
Halasuru (Outer Urban Neighbourhood Station)	Mixed Use	Commercial, Mixed residential, Hotels, High density, Restaurants,	Commercial, Mixed residential, High density, Restaurants, Public
Trinity Circle (Nearer Urban Core Neighbourhood Station)	Commercial	Multi-storied office and retail spaces, Mixed Use, Hotels,	Institutions, churches, public, semi-public spaces, Hotels
M. G. Road (Urban Core Neighbourhood Station)	Commercial	Retail businesses, entertainment, hotels, offices, defense land	Close to city core, wholesalers, Retail commercial
Source: Site survey and Bangalore Revised Master Plan 2031 Database (BDA, 2017)			

4.1 Delineation of Study Area Impact Zone:

To assess the impact of the Metro on this corridor, firstly we have to identify and delineate the transit influence area. Considering the literature review findings and also based on site visit validation, a 1km stretch on either side of the corridor classified has been defined as the Metro impact zone. help study the micro level influence of station proximity levels, the 1km radius study was further classified into three subsets of binary distance bands as 0-250m, 250m-500m, and 500m-1000m. The proximity of buffer zones is explained from the perspectives of walkability and

cycling convenience distances. The study area influence zone and binary range bands are mapped using ArcGIS base map overlays on Google earth maps on the Reach-1 corridor as shown in Figure-2.

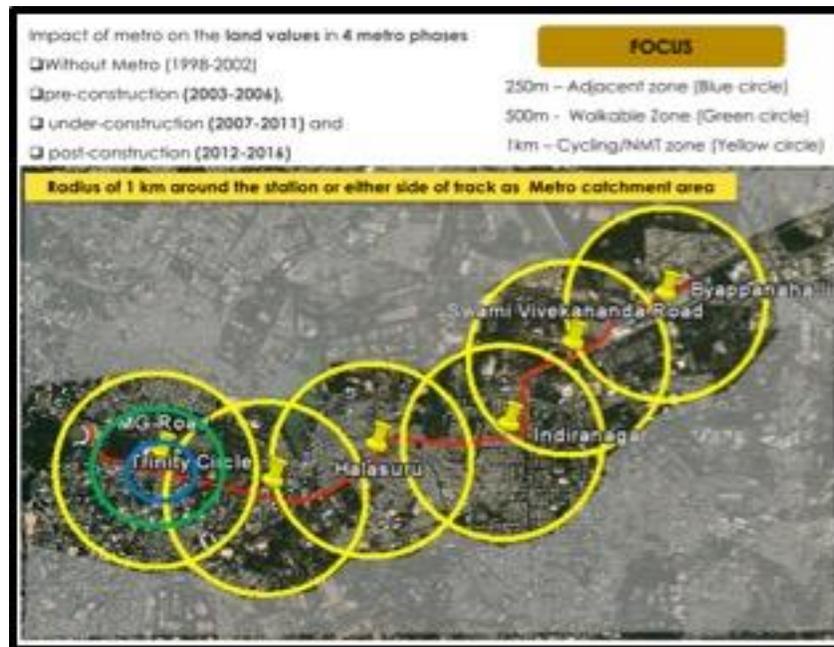


Figure 2: Study Area Delineation with Google Earth Overlay Map (not to scale)

As each station is roughly 1km distant apart, there is an overlapping area between two station catchment areas and again based on the nearest station location criteria, respective data are assigned to the respective station catchment area.

4.2 Methodology and Data

The data were analyzed concerning land value uplift through temporal and spatial variations. Land value changes were examined in comparison with accessibility, density changes and station proximity were assessed over a time series. The HPM regression was conducted with cross-sectional and longitudinal analysis. In this study, linear functional forms were used in the regression models. Four different regression types: Linear, Log-Linear, Linear-Log, and Log-Log were trailed for cross-section analysis to define the right fit model that derives the transit impact. A time series data of years 1998 to 2016 were analyzed with hedonic regression to comprehend the price patterns across different stages of project progress: as before metro, planning metro, metro in construction and metro in operations.

Pearson correlation values are tested to examine if there are multicollinearity problems among selected independent variables. Variance Inflation Factor (VIF) is analyzed to quantify the severity of multicollinearity. Wherever multicollinearity issues were found then principal component analysis was conducted. The F test results suggest that land value uplift could be explained as the combined influence of the identified variables. The adjusted R-square value was examined to

see the proportions of variations in land value price explained by the variations of defined variables. Coefficients and significance levels of each variable were validated. Both primary and secondary data sources of data were considered for this study. Land value data were used as the dependent variable. In India, getting actual land value data across time series is a big challenge due to the reliability of data sources and also on the format of the data availability. Not all the sources of data are comparable on a common baseline. The demographic census data is decadal; the GIS data is available at different distinct time zones, population and densities on different wards. Land values are on street or village or area.

Typically, the Department of Stamps and Registration authority of the State publishes guidance land values as reference values, popularly known as circle rates. These data are grossly lower than the actual market transaction prices for various reasons. The presence of any data biases were removed with data consistency checks and data cleansing comparing them with other data sources namely: land valuation data, land auction data, bank loan data records, land acquisition costs paid by transit, and other published real-estate prices obtained from various secondary data sources. Pilot data checks indicated that largely the prescribed guidance values are about 1.5 times to 3.5 times lower than actual market transaction values. This range is also varying with each year as there is a smaller gap in later years of data since 2012 and a huge gap of over three times in the early years of data since 1998. Accordingly, a data correction index was estimated and applied to the guidance values to ensure a fair market value price. Later a data sense-check was applied with validations done with CREDAI⁵ Bangalore city members and local users as part of a stakeholder survey and interviews. Overall a total of 1200 land price data records covering the 2km stretch of metro influence zone was collected for the years 1998 to 2016. The mean land values data of 288 data sets were used for panel data analysis. Also, for qualitative attributes, a representative stakeholder⁶ survey of 200 samples based on stakeholder perceptions was compiled with a weighted score index. These explanatory variables are listed in Table 5.

Table 5: Explanatory Data Variables

Station Proximity	Project status	Accessibility measure	Qualitative variables
Less than 250m 250m-500 500m – 1000m	1998-02 Without metro 2003-06 Metro Planning 2007-11 During Construction 2012-2016 Metro in Operation	Distance to CBD PT Index Walkability index Others Population Density	Multiplicity of use Travel time savings with Metro Peak Hour Traffic Congestion Current development Residential Potential Commercial Potential Mixed use development Redevelopment potential
Land Value Data per Sq.ft or SQ.m used as Dependent variable. Note: The year 1998, Station 1, and Station proximity buffer zone within 250m are considered as base reference data for the analysis.			

⁵ Confederation of Real Estate Developers' Associations of India,

⁶ The stakeholder group including; real estate developer associations (CREDAI), residents, government sources, and metro passengers.

Now using HPM cross-sectional and panel data regression models, the dependent variable has been predicted across a set of independent explanatory data variables.

5. HPM Cross-Sectional and Panel Data Analysis

5.1 Land Value Uplift: Cross-Sectional HPM model analysis, 2016

The descriptive statistics for the HPM cross-sectional model for the year 2016 are in Table 6 with about 67 different data locations captured.

Table 8(6): Station and Proximity Descriptive Statistics

a. Frequencies of Nominal Variables				
Variable	Code	Value Label	N	
Station code	1	Byappanahalli	6	
	2	S V Road	7	
	3	Indira Nagar	6	
	4	Halasuru	9	
	5	Trinity Circle	16	
	6	M G Road	23	
Proximity to Station	1	Within 250m (metro adjacent zone)	16	
	2	250m-500m (walkable zone)	21	
	3	500m-1000m (cycling zone)	30	
Multiplicity of uses	0	No, only residential	15	
	1	Yes, mixed uses	52	
b. Station and Proximity Descriptive Statistics				
Dependent variable: Land value per sq.ft for the year 2016				
Proximity	Station	Mean Per Sq.ft	Std. Deviation	N
Within 250m	1	22113	0.000	2
Within 250m-500m		8750	0.000	2
Within 500m-1000m		9900	0.000	2
Total		13588	89.443	6
Within 250m	2	10954	282.843	2
Within 250m-500m		20625	0.000	2
Within 500m-1000m		9817	57.735	3
Total		13230	1057.14	7
Within 250m	3	22053	2121.320	2
Within 250m-500m		35885	1272.792	2
Within 500m-1000m		21366	565.685	2
Total		26435	1583.246	6
Within 250m	4	13588	115.470	3
Within 250m-500m		24217	141.421	2
Within 500m-1000m		13030	330.404	4
Total		15702	258.736	9
Within 250m	5	23489	305.505	3
Within 250m-500m		23359	1376.504	7
Within 500m-1000m		13268	725.948	6
Total		19599	1386.948	16
Within 250m	6	32657	1969.772	4

Within 250m-500m		33423	2485.443	6
Within 500m-1000m		24225	2326.645	13
Total		28091	2396.645	23
Within 250m	Reach-1 Stretch (Overall)	33100	2107.645	16
Within 250m-500m		27990	2352.409	21
Within 500m-1000m		17312	1881.806	30
Total		26000	2086.155	67

The first trial with linear regression was found to have an R^2 value of 50.8% with good fit significance levels but with a high degree of multicollinearity among explanatory variables making them largely interdependent. Any regression model built with such multicollinearity may result in insignificant coefficients for variables and thus be not reliable. To resolve the multicollinearity an exploratory factor analysis (EFA) was performed (principal component analysis and rotated component matrix using Varimax with Kaiser Normalization rotation method used). EFA grouped them into a new set of variables based on the extent of correlation between them and transformed them into seven new components as given in Table 7. These seven factors are independent with about 96.7% of variation explained and thus can be taken as proxies for all the explanatory variables.

Table 9 (7): EFA Component Variables and Variance Percentage Explained (using SPSS) 2016

EFA Component Variables	Correlated Set of variables (+ve or -ve correlation) in each component	Proportion of variance
Factor 1	Positively with station proximity of less than 250m	20.096
Factor 2	Positive with Station 2, Log distance to CBD	18.046
Factor 3	Positive with station proximity of 250m-500m, Multiplicity of uses	17.312
Factor 4	Positive with station 4 and negative with Regeneration potential	12.436
Factor 5	Positive with Station 3, with station proximity 500m-1000m and Log commercial development, Log PT Index	11.560
Factor 6	Positive with Log Density, Station 5, current development perception	9.490
Factor 7	Negative with Station 2, Log residential growth	7.898
Total Percentage of Variance explained (%age)		96.659

Now using these new set of seven transformed variables the four different regression forms are examined. The summary of cross-sectional HPM data analysis with various regression functional forms (linear, log-linear, linear-log and log-log) are shown in Table 8.

Table 10 (8): HPM Models Summary and Analysis of Variance (ANOVA) 2016

Model	Model Summary			ANOVA	
	Function	Adjusted-R ²	Standard Error of Regression	F value	Significance
Cross-sectional HPM	Linear	0.386	1634.56	52.74	0.000
	Linear-Log	0.376	1648.56	32.42	0.000
	Log-Linear	0.386	1634.56	51.37	0.000
	Log-Log	0.569	0.4425	86.67	0.000

Among them, the Log-Log model has maximum Adjusted Coefficients of Determination (Adjusted-R²), and the smallest homoscedastic distribution of residuals matching the criteria for use in cross sectional analysis. The details are given in Table 9.

Table 11 (9): Results for Namma Metro Reach-1 Cross-sectional OLS Log-Log HPM Model (2016)

Regression Factor Score	Explanatory variable	Coefficients	Significance	% increase in mean Land value with a unit in factor variable
Constant		7.760 (0.015)	0.001***	
Factor 1	Within 250m to metro station (Dummy)	0.416 (0.005)	0.000***	41.6%
Factor 2	Log distance to CBD, Station 2 (Dummy)	-0.092 (0.001)	0.005***	-9.2%
Factor 3	Walkable station 250m-500m (Dummy), Multiplicity of uses (Dummy)	0.396 (0.003)	0.000***	39.6%
Factor 5	Within 500m-1000m (Dummy), Log commercial growth, Log PT Index, Station 3 (Dummy)	0.256 (0.002)	0.018**	25.6%
Note: 1. Figures in brackets report parameter's standard errors, *** Significance at the 0.01 level indicated by three asterisks, Significance at the 0.05 level by two asterisks.				
Congruence Statistics				
Number of Observations:67		About 60% of the variations for land value uplift explained by this model with metro transit impact.		
Adjusted R-square – 0.569				
R-square – 0.597				
Equation 4 (2) Land Value Uplift Model Developed for the Project				
(using Cross sectional HPM Log-Log):				
Log (land value/sq.ft) =	Constant + B ₀ [Station Code] +B ₁ [250m catchment_dummy] + B ₂ [500m catchment_dummy]+B ₃ [1km catchment_dummy]+B ₄ [Log Dist to CBD] + B ₅ [Log Density]+ B ₆ [Log PT Index]+ B ₇ [Log walkability Index]+ B ₈ [time savings]+ B ₉ [peak congestion]+ B ₁₀ [comm.dev]+ B ₁₁ [resi.dev]+ B ₁₂ [mixed land use]+ B ₁₃ [current dev.] + B ₁₄ [redev. potential]			

5.1.1 Discussion and Results of HPM Cross-sectional analysis

The cross-sectional results for the year 2016 are summarized below.

1. The results of HPM cross-sectional models demonstrates that it is statistically significant and can therefore elucidate the metro rail transit impact.
2. Station proximity levels can explain the importance of the proximity-based influence of a station. About 42% land value uplift has been noted with the plots that are closer to the station

(within 250m), about 40% land value uplift within 500m and about 26% land value uplift within 1000m.

3. There is not much difference noted between the 250m and 500M zone. Hence it can be concluded that the major land value uplift should be attributed to station proximity within the walkable distance of 500m.
4. The land values are inversely related to the proximity distance from the metro station.
5. The higher increase within the 500m walkable zone is associated with the higher density zoning, or FAR premium, allowed within this area.
6. The shorter the distance from the city center has also shown to be related to the top land price in all stations with an exception of station 3. In fact, compared to MG Road (station 6), all other stations demonstrated lower land value uplift but for Indira Nagar (station 3) which had a higher percentage of land values. This is discussed further below as it is unusual.
7. Respondents have confirmed huge travel time savings using the Metro and also not observed any reduction in peak hour road congestion. This is explainable because it takes little time to replace congestion reduction due to induced travel demand (Newman and Kenworthy, 2015), and it takes time to generate network impact with Phase-1 of 48.3 km only operationalized recently. Also, it could be that initially most of the modal shift is happening from buses than from cars or two wheelers. Possibly car traffic will be reduced in future with improved last mile connectivity, support infrastructure development around station areas, and place making initiatives for safer walkability around stations.

5.2 Longitudinal Panel Data (Log-Log) HPM model

Panel data modeling was considered with Station1. The year 1998 and the 250m proximity zone were chosen as base data. The initial linear regression analysis exhibited VIF of some variables above 2 indicating multicollinearity among them. Hence EFA factor analysis was performed, and variables were assorted into 21 component data sets with 98% variation explained. A summary of Linear and Log-linear regression forms based on HPM panel data analysis with the new set of factor variables are given in Table 10.

Table 12 (10): HPM Panel Data Model Summary and Analysis of Variance (ANOVA)

Model	Model Summary			ANOVA	
	Function	Adjusted-R ²	Standard Error of Regression	F value	Significance
Panel Data HPM	Linear	0.799	1128.248	51.874	0.000
	Log-Linear	0.920	0.4425	120.67	0.000

The results of the regression model demonstrated a significance level below 0.05. ANOVA results with 0.000 significance level and adjusted R² of about 92% explanation for all the different

regression models confirm that the Log-Linear model is a good fit. The Ordinary Least Squares (OLS) HPM panel data model results are given in Table 11.

Table 13 (11). OLS Log-Linear HPM Panel Data Analysis for Namma Metro Reach-1

Factor variables	Explanatory variables	Coefficients	Significance	% increase in mean Land value with a unit in factor variable
	Constant	7.760 (0.015)	0.001***	
Factor 1	Within 250m (Station adjacent), station 3	0.396 (0.021)	0.000***	39.6%
Factor 3	Within 500m (Station walkable), Station 6	0.385 (0.037)	0.000***	38.5%
Factor 5	Within 1000m (Station bike zone)	0.237 (0.016)	0.000***	23.7%
Factor 2	Distance to CBD and Station 1	- 0.028 (0.049)	0.002***	
Factor 4	Density, Multiplicity of uses and Station 4	-0.314 (0.078)	0.000***	
Factor 6	Commercial Development Potential (Scale of 1 to 10), Station 2, Residential Growth Potential (Scale of 1 to 10)	0.351 (0.083)	0.013***	
Factor 7	Perception rate on current development (Scale 1 to 5), Perception rate on redevelopment potential (Scale 1 to 5)	0.026 (0.075)	0.014**	
Factor 8	Dt_2002 (Pre-metro)	0.071 (0.066)	0.001***	
Factor 9	Dt_2003 (Pre-metro speculation)	0.250 (0.071)	0.047**	
Factor 10	Dt_2004 (Pre-metro speculation)	0.203 (0.034)	0.037**	
Factor 11	Dt_2005 (Pre-metro speculation)	0.207 (0.042)	0.002***	
Factor 12	Dt_2006 (Pre-metro speculation)	0.218 (0.081)	0.000***	
Factor 13	Dt_2007 (metro construction)	-0.060 (0.070)	0.011**	
Factor 14	Dt_2008 (metro construction)	-0.007 (0.054)	0.004***	
Factor 15	Dt_2009 (metro construction)	-0.087 (0.089)	0.000***	
Factor 16	Dt_2010 (metro construction)	0.246 (0.016)	0.000***	
Factor 17	Dt_2011 (metro construction)	0.453 (0.015)	0.000***	
Factor 18	Dt_2012 (Post metro)	0.803 (0.029)	0.007***	
Factor 19	Dt_2013 (Post metro)	0.902 (0.035)	0.000***	
Factor 20	Dt_2014 (Post metro)	0.867 (0.012)	0.006***	
Factor 21	Dt_2015 (Post metro), Dt_2016 (Post metro)	1.105 (0.053)	0.017**	
Dependent Variable: Log Land Value per sq.ft Number of Observations: 1200 Notes: Figures in brackets report parameter standard errors. ***Significance at 0.01 level, **Significance at 0.05 level, *Significance at 0.10 level				

5.2.1 Discussion and Results of HPM Panel Data Analysis

The results of HPM panel data models presented in the above tables demonstrate that they are statistically significant with less than 0.05 significance levels and are therefore valid.

1. Overall, the land values have significantly gone up in the years 2014 to 2016 more than the base by about 60% of the base values.
2. Similar to the cross-section analysis, station proximity levels have impacted the land value uplift and are inversely related to the station distance. About 40% land value uplift has been noted in adjacent zones of the station within the 250m catchment area, about 39% land value uplift within walkable distance covering up to 500m and about 24% of land value uplift within the cycling or Autorickshaw transport zone within 1km.
3. Pre-metro prices are 45% lesser compared to post metro prices indicating a jump in the land prices once the Metro process planning started.
4. Places which are around 500m to 1km away from the station are approximately 31% lower in value compared to places which are nearer to the station.
5. Coefficients for Factors 13, 14, and 15 are negative as in the years 2007 to 2010 land prices were significantly affected in proximity areas due to the Metro construction phase.
6. The coefficient of factor 2 is negative as the distance to the CBD impact was noted but with a lower proportion. As the distance from the city center is increasing the land values are falling but for Station 3 Indira Nagar, which is again an exception.
7. Another interesting finding is that the land values uplift difference between the 250m catchment zone and the 500m catchment zone is marginal. Possibly if we revise the binary distance bands to cover frontage plots alone within the 150m distance and within the 500m zone, might give better results. However it may also be explainable in terms of the extreme activity levels with Autorickshaws and taxis in the area immediately around stations.

6. Willingness to Pay Estimate (WTP)

The land value uplift percentages indicate the people's willingness to pay (WTP) for the transit. A general appraisal is given in Table 12.

Table 14 (12): WTP analysis for Reach 1 (per Sq.m and in US Dollars)

a) WTP based on HPM Cross-sectional data, in US\$ 2016		
Proximity	Mean Land value per sq.m	Willingness to pay per sq.m
Within 250m	356286	148215
Within 250m-500m	301280	119307
Within 500m-1000m	186340	47703

Total corridor impact value	279862	105075 (US\$1638) ⁷
<p>Result: Data ascertains that people willing to pay more to station proximity. Value Capture Potential (Lost Opportunity): If we assume about 2% of land transaction happened within this influence corridor of 12.94 sq.km area during the year 2016 than at an average price of rail impact share in US\$ 1226 per sq.m may yield about US\$ 317.28 mn. Such is the profit potential today enjoyed by land owners and private builders and with a small tax share with the investors (Government) due to lack of strategic land value capture measures.</p>		
b) WTP based on HPM Panel data in US \$ (1998-2016)		
Year	Av. Land Price	WTP for 250m
1998	\$361.12	\$9.69
2002	\$519.06	\$3.46
2003	\$646.07	\$346.62
2004	\$1,024.32	\$570.46
2005	\$1,317.42	\$639.61
2006	\$1,786.76	\$245.41
2007	\$1,836.71	-\$91.84
2008	\$1,852.56	-\$17.21
2009	\$2,023.82	-\$9.37
2010	\$2,200.86	\$31.83
2011	\$2,206.60	\$228.63
2012	\$2,376.76	\$896.74
2013	\$3,089.47	\$1,023.38
2014	\$3,723.35	\$1,312.79
2016	\$4,364.66	\$1,191.89

6.1 Discussion and Results of WTP Analysis

1. Overall both HPM models demonstrated the people's willingness to pay more for station proximity.
2. This is more evident in the panel data results which showcased negligible WTP during the 'no metro' period and also slightly negative during construction especially within the 250m station buffer zone, which was faced with noise, pollution and disruption to businesses during the construction period. However, this became a very high WTP during the Metro planning period and the post operations period.
3. The upper WTP beyond 2013 onwards was mainly due to increases in density zoning (called FAR in India) from 2.25 to premium four extending up to the 500m distance which opened up an enormous opportunity for land development in a TOD area obviously in demand.

⁷ Estimated currency exchange rate 1 US\$ = INR 64.12 as on 20 Aug 2017

7. Land values uplift as a function of time

The time-based results have re-validated the spatial data findings. Figure 6 illustrates the pattern of land values change across the time series between 1998 and 2016 covering all the pre-, during- and after- metro phases of selected Metro study corridors.

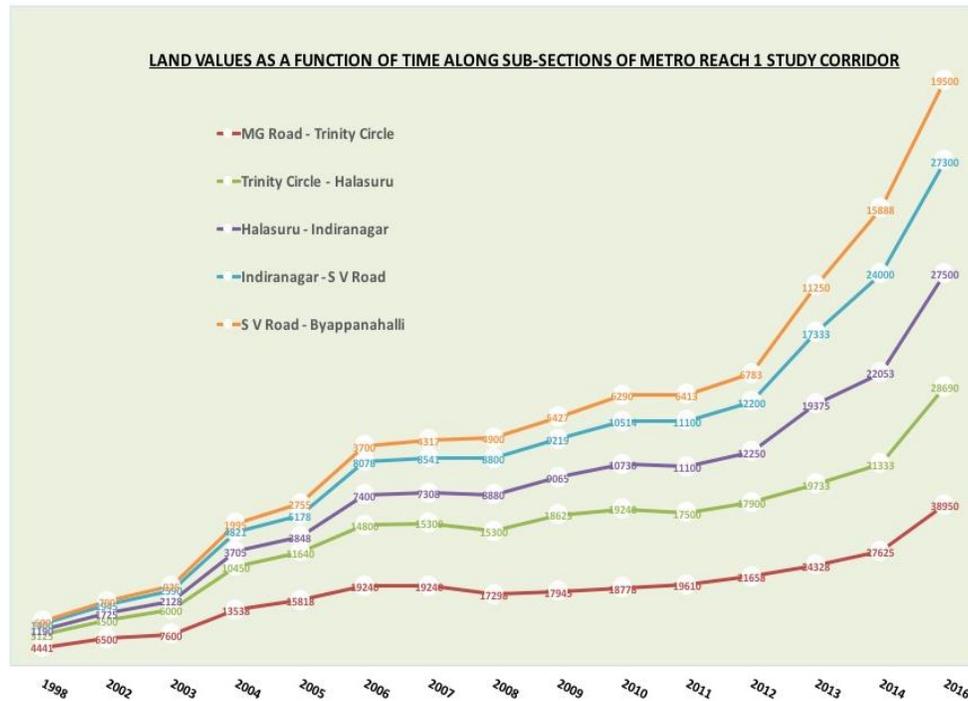


Figure 6: Land Values Change Pattern Over Time for Sub-sections of Metro Study

The following are the inferences from the data in Figure 6.

1. All the subsections of Reach -1 show that the corridor has achieved steady growth with Metro-based land value uplift.
2. The higher growth between 2002-2006 as compared to 1998-2002 was the Metro planning phase with massive speculation and excitement which appears to have propped up the price rise. A similar result was observed in Perth (McIntosh et al, 2012).
3. The land prices were rather slightly lowered between the years 2007 and 2011 due to construction activity.
4. Since the launch and post operations period the Reach-1 Metro corridor has continued to show a steep rise in land prices.

5. Indira Nagar (Station 3) have seen very high growth compared to other stations. The low developed areas like SV Road, Byappanahalli also received a sudden surge in their prices within 1km station proximity levels.
6. Since the year 2014 onwards the spur of demand for land is noted particularly with Indira Nagar, SV Road, and Byappanahalli stretches. This demand is reflected in the introduction of premium FAR 4 within their 500m buffer zones.

These patterns of price change and the trend are further explained by plotting the Compound Annual Growth Rate (CAGR) for different phases of development. The CAGR comparisons are illustrated in figure 7. The CAGR values for the subsections of Reach -1 study corridor over a Metro project implementation phase show the pattern of land values during different phases with a particularly striking reduction during construction. There are also variations between the stations.

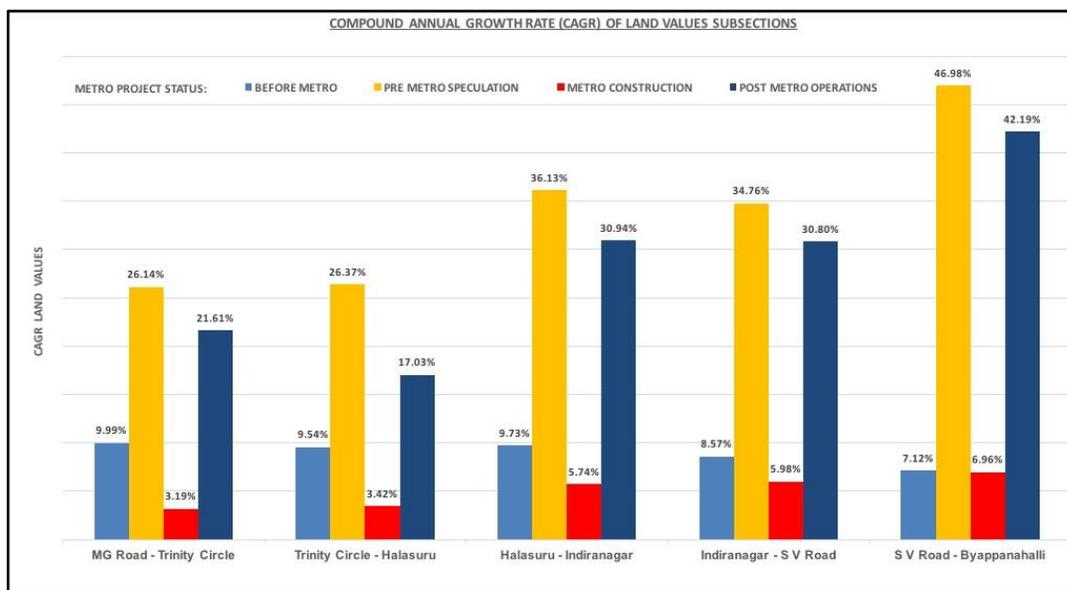


Figure 7: CAGR of Land values over different project implementation phases

1. M G Road-Trinity and Circle-Halasuru station catchment areas are considered to be already developed areas due to their CBD proximity and are also deemed to be expensive areas. Before the Metro, the growth pattern was between 7% and 10%. Substantial increases then occur but they are not as large as the others because the land is already well established so it cannot grow as fast.
2. The huge surge in land prices during the Metro planning period (with a range of 25% to 50%) is more noticeable in the less developed areas namely SV Road – Byappanahalli, Indira Nagar – SV Road stretch, and Halasuru – Indira Nagar stretches.
3. Before the Metro, Indira Nagar was a purely residential area, but due to Metro accessibility there was a steep rise both in the Metro planning and post operation phases.

4. The Metro construction phase showed a dip in the land value prices with slower growth between 3% and 7% only for each of the stations but most noticeably in the established areas close to the CBD.
5. The Post Metro operations have the largest growth rates, especially in the newer areas with the growth rates ranging between 21% and 42%.

8. Land Value uplift as a function of distance from CBD

Traditionally, urban land values decrease when moving away from the CBD (according to the Alonso-Muth-Mills model) but as shown above something different is happening in at least one of the TOD's in this study. Thus, further detail is examined on the land values of each station against

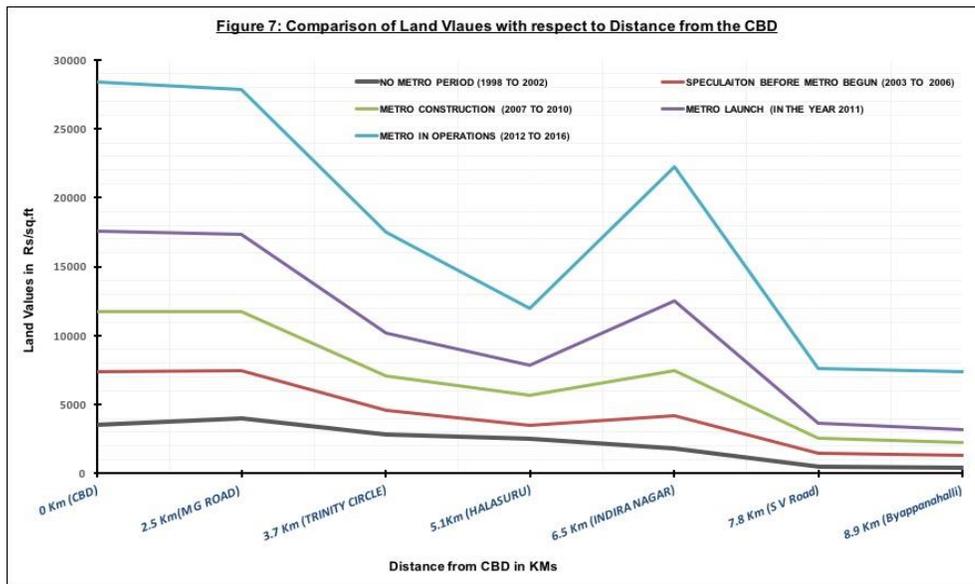


Figure 8: Comparison of Land Values in stations with distance from the CBD

the Metro stations' distance from the CBD area to examine just how special are the findings on the Indira Nagar TOD. The strong results are provided in Figure 8.

The trend analysis of the data shows that the average land price instead of declining uniformly by distance from the CBD has shown an inverted "V" shape around the Indira Nagar station which is over six kilometers distance from the CBD. The first station at M G Road could be ignored as it is so close it could be considered as being within the CBD area. However, the second peak is impressive as the land values at Indira Nagar indicates the station has emerged as a multi-nodal center which is 6.5 km away from the CBD but has land values challenging those in the CBD.

The Indira Nagar data is more pronounced than the other non-CBD stations from 'announcement' to 'metro operations commenced'. Thus, there is a strong growth tendency observable around Indira Nagar station from the speculative period onwards. It means the Indira Nagar TOD is developing as a major multi-nodal center based around the Metro's ability to facilitate urban

growth. This is a significant finding for any city seeking to become a more polycentric sustainable city.

Based on these case study learnings the following section proposes a macro-level rail impact assessment framework.

9. Strategic Rail Impact Assessment (SRIA) Framework

This research suggests that a metro station-centered urban growth strategy is likely to work in India as suggested by similar studies around the world (Newman and Kenworthy, 2015). An eight-step strategic rail impact assessment (SRIA) framework has therefore been constructed offering step-by-step sequential guidance for any city but especially emerging cities with growth potential and traffic problems. See Table 13.

The framework provides a macro-level impact assessment process flow explained in eight steps providing step-by-step sequential guidance. Hedonic cross-section data analysis with multiple check points can yield the data required for decision making as such an approach is much faster and reliable at estimating the potential land value capture. Transit projects are highly capital intensive, and built over five years on average, thus, a series of data collections are recommended for impact assessments starting from the planning phase. Such assessment of results will help understand the following:

- Transit project journey of value creation from time to time
- Optimize the benefits both from financial and socio-economic perspectives
- Provide opportunity for course correction
- Aid decision making on alignment, phases, priorities, implementation plans
- Aid decision making on strategic value creation and value capture.

Table 15 (13). Strategic Rail Impact Assessment (SRIA) Framework

Steps	Description	Categories	Outcome
Step 1: Study definition	Define study objectives Identify study groups as land/residential/commercial or all of them	Land Residential Commercial Rental All included	Purpose Defined
Step 2: Case Study Area (s)	Identify study area		
Step 3: Select the corridor	Option 1:	Stretch without rail	To compare
	With transit line (if different stages available in one point of time picking each one of them)	Planning Stretch	Speculation trend & value capture
		Construction Stretch	Incentivizing period
		Operations Stretch	Value capture

	Option 2: Otherwise on stretch but with time series data including all those phases)	Stretch with time-series	Pre-Planning-Construction-operational phases of Metro
Step 4: Define TOD Transit Impact zone	0-150m	Frontage Plots	Typically, One Kilometer on either side. For developing countries, one Kilometer is popular considering walking length is at least 500m.
	150-500m	Walkable zone	
	500m-1000m	Cycling zone	
	1000m-1500m	Optional -low impact zone	
	1500m-2000m	No influence zone	
Step 5: Data Requirements	Data Source & Collection	Data Cleansing and consistency checks	Data coding for analysis
Dependent Variable (Per sq.ft or Per sq.m)	Land Value Property value Commercial values Rental values	(Note: Impact objective will select the category)	Land values based on years or proximity levels
Independent Variables	Base Year, Base Proximity within 150m and Base Station code to be set for analysis.		
Year Dummy	In case of Time series		Time series
Proximity Attributes (Dummy Variables)	0-150m	Frontage Plots	Help understand the impact based on nearness to transit.
	150-500m	Walkable zone	
	500m-1000m	Cycling zone	
	1000m-1500m	Optional low impact	
	1500m-2000m	No influence zone	
Accessibility Measures	Distance to CBD	Negatively relation	
	Public Transport Index	Higher patronage	
Station Code (Dummy Variable)	Stations can classify code based on the number of stations	Station Classification Urban core, Sub-urban core or further classified concerning its location from CBD	
Station Catchment Attributes	Neighborhood attributes	Surveyed responses	
	Development Potentials	Surveyed responses	
	Civic facilities index	Secondary Data	
	Socio-Economic Index	Secondary Data	
	Population Density	Secondary Data	
Other Parameters	Travel time savings	By metro	
	Reduction in Congestion	Due to metro	
	Predominant Land use	Land use changes	
Step 6: Data Analysis	Hedonic Cross-sectional analysis	ANOVA, VIF & F	Multicollinearity issues

	CAGR	Percentage Plots	Trend
	Simple average plots	Mean values plot	Descriptive
	Hedonic Panel data	ANOVA, VIF & F	Multicollinearity issues
Step 7: Willingness to Pay	Assess based on Transit attributes	Transit Proximity	Value created by Transit – How to maximize
Step 8: Willingness to Share	Either share or Capture	Stakeholder Deliberation	Value capture policy decision – How and when to capture
End			

10. Conclusion

The study results confirm that the Bangalore Metro rail project can catalyze TOD's around the rail corridor and also generate significant land value uplift with potential to capture this for financing such rail building. Overall the results using HPM cross-sectional and panel data modeling vividly demonstrated that land value uplift due to urban rail impact around TOD station areas of within 500m radius is substantial and that it continues out to 1000m radius. With increased connectivity between east-west and north-south areas of Bangalore, more and more housing or commercial projects nearer to Metro stations will be gaining demand as commuters are attracted by the reduced commuting time to work. The returns on investment of such projects are considerably higher given the fact that people are willing to pay a premium for proximity to the Metro. If such a premium is shared up front or strategized to capture as Strategic Value Capture (SVC) (see Jillella, 2014) then the Namma Metro can in fact help to pay for itself. Without SVC there is a lost opportunity for Metro investors and Bangalore citizens in general as the value is simply translated into a real estate bonanza which yields unearned private gains to land owners.

The study results have demonstrated that Bangalore is ready for value capture mechanisms with proven attraction and willingness to pay more for when density zoning increases using premium FAR 4 are introduced within the 500m proximity area. In Bangalore, the moment this boundary extended up to 500m after the opening of the Metro, it just opened up a land of opportunities and scope to amalgamate smaller plots that encouraged builders and developers.

However, no value capture mechanisms have yet been used in Bangalore. Thus, in the next phases of the Metro it is suggested that the planning and delivery of the Metro should now include Strategic Value Capture mechanisms using the Strategic Rail Impact Assessment Framework outlined in this paper to better fund the rail projects and create more TOD's.

The Bangalore polycentric trend has now possibly converged around the Metro stations as a nucleus for potential TOD opportunities. The data in this paper show where the highest TOD potential is now being demonstrated. Similar centers are possible in other corridors if the Indira Nagar TOD lessons are learned. Such development is healthy for the market given the obvious demand to live there and it is more sustainable as it helps encourage more walkable and cycling zones with mixed use potential and higher densities within the 1km radius of station areas. Such a trend also underscores the need for station area planning with guided TOD approaches to help

transform the unfocussed Bangalore sprawling urban morphology more into a multi-nodal, Metro station-centered sustainable urban development.

Though the Bangalore metro was originally initiated more as a sustainable mobility solution its dynamics and impact are now indicating an urban development strategy that can help transform Bangalore into a far more sustainable TOD-based city. Such a conclusion has obvious application to any growing city in the emerging or developed world.

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Conflicts of Interest

The authors declare no conflict of interest.

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Book Chapter 1: Emerging Value Capture Innovative Urban Rail Funding and Financing: A Framework

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Chapter 6

Emerging Value Capture Innovative Urban Rail Funding and Financing: A Framework

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ABSTRACT

Urban rail transit is emerging around the world as a catalyzing developmental solution to enable 21st century sustainable cities. However, these transit systems are capital intensive and cities worldwide are seeking innovative funding and financing mechanisms. Recently, land based value capture (VC) mechanisms have emerged as a pioneering solution to fund urban rail projects. This chapter introduces the VC concept and provides global best practice. The chapter aims to help enhance the understanding and rationale behind VC approaches through assessing the transit impacted accessibility value proposition and various VC mechanisms to capture the value created. A six-step Strategic Value Capture (SVC) framework is proposed which offers a step-by-step guidance to help define the VC based urban rail transit funding and financing processes from VC planning to VC operations.

Emerging Value Capture Innovative Urban Rail Funding and Financing

INTRODUCTION

Cities across the globe have pressures to build urban rail transit systems as a solution to a range of urban mobility issues driven by rapid urbanization challenges. These urban rail transit systems include metro (or subway systems), mono rail and light rail systems. There is a growing recognition among cities across developed and developing nations that urban rail transit helps maintain a city's economic competitive-ness and also helps to enable livable and sustainable communities around station areas. There has been a dramatic turnaround in rail's fortunes globally as well as an increased awareness of rail's value to enable 21st century cities to achieve their sustainability goals (Newman et al., 2013). For example, in India currently urban rail (metro) is operational in 9 Indian cities, with another 7 cities currently constructing metros and a further 14 cities with rail transit in the planning stage. A further 16 cities have rail transit under initiation and eight regional rail corridors from Delhi are being planned. However, despite this move towards rail transit, none of the operational urban rail systems in India are financially viable and they are heavily dependent on government subsidies and grants. This is a problem worldwide (Gadgil, 2011) leading to the question *how can urban rail transit systems be funded and financed?*

Traditional funding sources for urban rail transit that include a mixture of federal and state aid grant programs, local taxes and fees, are grossly inadequate to meet the demand for new urban rail infrastructure. In the United States these traditional resources are typically combined to fund projects on a "pay-as-you-go" basis, meaning that projects have often been built in phases or increments as funds become available over a period of years (Chen, 2012). The scenario is not much different in other countries, even in developing economies. Many cities in developing countries depend on scarce grants from Federal or State governments or on loans from donor agencies with limitations leading to funding shortfalls to create any new urban rail transit infrastructure. Urban rail systems are being constrained as a social sector project as it is difficult to increase the fares beyond a point. Turning to the private sector for financing only works with urban rail if the necessary funding is provided to enable private financing to achieve their necessary

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return. A confluence of all these factors has prompted an urgent need to look for innovative funding and financing mechanisms to build such projects and enable them to be sustained. In this context, land based value capture (VC) mechanisms, through the monetization of urban land values, are gaining attention as an innovative solution to fund urban rail projects and enable the involvement of private financing. Many studies have established the relationship between urban rail services, accessibility and residential and commercial property values (see below) and this is providing the basis for establishing mechanisms that can capture some of this value as alternative funding. Though it is not new to recognize the value of integrating transport and land use, it is new to integrate these with funding and financing, and is conceptually more challenging (Cervero, 1994; Newman & Kenworthy, 1999; Newman et al., 2013).

This chapter first introduces the concept and rationale of a value capture based rail transit funding and financing approach, introduces various VC mechanisms, and then shares some of the global experiences from cities across North America, Australia, Africa and Asia regions in utilizing VC to fund urban rail. The chapter further elaborates on the various successful VC mechanisms suggested for value capture implementation towards achieving sustainable urban mobility goals, and also identifies future research requirements in this important area. There is limited research available with regards to VC implementation, VC fund governance and VC strategic deliverables, especially for urban rail transit in an emerging cities context but also in many places like Europe and Australia where the mechanism is not used yet. In this chapter, the authors have tried to address these limitations by introducing a six-step *Strategic Value Capture (SVC)* framework. The SVC framework offers step-by-step methodical guidance to help define the VC process from VC planning to VC operationalization within the context of an urban rail transit financing project.

The topic of this chapter is of interest to policy makers, treasuries, city and transport planners, developers, economists, government agencies, mass transit organizations, academics and infrastructure banks.

*Emerging Value Capture Innovative Urban Rail Funding and Financing***BACKGROUND**

Historically, it is evident that transportation infrastructure, especially urban rail transit infrastructure, effectively creates time utility, and space utility, thereby, adding value to people, goods, and markets by improving accessibility and through catalyzing land development opportunities. Local government initiated community infrastructure improvements have been shown to lead to increased local land values through streets, sidewalks, water and energy resources, schools, hospitals, businesses, up-zoning, parks, and mass transit stops/nodes. Generally, these infrastructure investments are sourced through tax revenue and/or grants. However, the local land owners and property developers gain the benefits and profits from these increased in land values as unearned income by their proximity. Land and property values vary spatially due to differing characteristics of properties' location, land use type, neighborhoods and accessibility amongst other characteristics. The real challenge for VC in regards to enabling capital for transit investment is to establish what portion of the increase in property values is due to the impact of the transit investment proposed versus the other many contributing factors and then seek to capture part of this value as the basis of a funding and financing mechanism.

Construction of a new highway will also spur development along the road network and thereby increase the value of adjacent land and properties. However, unlike rail transit, the accessibility gains found from the highway investment only hold for the initial few years. Then the accessibility gains are reduced due to congestion through this investment encouraging an increase in vehicle population. By contrast, investment in urban rail transit systems not only enable the initial accessibility gains and increases in demand but also enable increased accessibility on a continuous basis (Levinson & Istrate, 2011). The underlying success factor is that the beneficiary people, namely the land owners, residents, business communities near the transit stations, are willing to pay for their accessibility and hence may be willing to help with raising the funds to pay for the rail, otherwise they do not get the accessibility and land value changes (McIntosh et al, 2014a).

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VC CONCEPTS AND RATIONALE

VC is the process by which all, or a portion of, increments in land value attributed to the public investments independent of land or property owner interactions are ‘captured’ by the public sector to recover the full, or a portion of, the public investments made. Medda (2012) defines VC as it refers to a type of innovative public financing in which, increases in private land values generated by a new public transportation infrastructure investment are all or in part “captured” through a land or property related tax or any other innovative mechanism, to pay for that investment or other public projects. Smolka (2013) explains that the notion of VC is to mobilize for the benefit of the community at large some or all of the land value increments (windfall or unearned income) generated by actions other than the landowner’s such as public investments in infrastructure or administrative changes in land use norms and regulations. In recent times, a few cities worldwide have tried out value capture mechanisms to fund urban rail transit systems by tapping increases in urban land values due to the rail transit proximity as an alternate funding source. Bahl and Linn (2013) examined VC practices in over 50 cities and concluded that all cities (except Hong Kong and Singapore) had a deficient experience in the implementation of VC, and in the VC mechanisms applied and had varying levels of success. Thus, although the theory seems to be accepted the practical implementation may have some way to go. As a first step in defining the VC based funding and financing strategies for transit projects, it is important to understand who are the key stakeholder groups to be involved or focused in defining the VC based transit financing process.

VC Stakeholders

Jillella et al., (2014) identified and classified the VC stakeholders in a VC based rail transit project con-text into three groups namely: investors, beneficiaries and the community (page 4-5). Table 1, adapted from Jillella et al. (2014), illustrates the various VC stakeholders and their aspirations across these three groups in the context of rail transit project funding and financing. Firstly, the *investor group* is the stakeholder group that provides the capital or investment for the project and constructs the project. Based on the nature of the project contract, the investor group may broadly

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include public agencies, private sector companies, local bodies, railway agencies and donor organizations such as banks. This group is primarily responsible for building the infrastructure, and creating a public good based value proposition, and also generally requires a return on the investments made. The second group, the *beneficiary group*, is the stakeholder group who benefits from the delivery of the project, generally through their proximity to the project. These stakeholders include those within the project catchment area, and generally include land owners, real-estate developers, businesses and vacant public land owned government agencies. Primarily these stakeholders accrue the benefits due to the implementation of the rail project as windfall gains such as increased accessibility, increased property values, increased rents, agglomeration of new economies, and/or land use changes, amongst other benefits. These stakeholders play a key role in defining the VC process from the perspective of the proposed project value proposition and also their willingness to pay for such benefits and participate in the VC process. Lastly, the *community group* is the stakeholder group which includes the local community members with direct access to the project. Particularly important in this group are the low income

Table 1. VC based urban rail funding and financing project stakeholders and their aspiration (adapted from Jillella et al., 2014)

Groups	Stakeholders	Aspirations
Investors	<ul style="list-style-type: none"> • Public agencies • Private sector • Local bodies • Railway agencies • Donor agencies 	<ul style="list-style-type: none"> • Build infrastructure • Improved productivity • Return on investment • Regulations & budget • Sustaining operations
Beneficiary	<ul style="list-style-type: none"> • Land owners • Real-estate • Developers • Businesses • Government with public land 	<ul style="list-style-type: none"> • Land values appreciation • Windfall gain • Speculation • Private developments • Land banking
Community	<ul style="list-style-type: none"> • Local residents • Local businesses • Low-income group • Civic societies • Precinct community 	<ul style="list-style-type: none"> • Improved accessibility • Improved commuting • Improved business • Value shareholders • Sustainable mobility

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community groups within the vicinity of the project, civic agencies, precinct community members and groups and the city tax payer community at large. Primarily this group will aspire for sustainable mobility, accessibility improvements and sustainable land development along the project.

Understanding the aspirations and cross-sectoral objectives of these three stakeholder groups provides a solid platform to define the appropriate VC process to be undertaken. By involving these groups in the early stages of the project planning can also help validate the best transit alignment options and also elicit value proposition potentials through elevated or underground or at surface based transit operations. Further the authors strongly recommend that a participatory stakeholder engagement route is undertaken to plan the VC process from the planning stage to the implementation stage as this is a key success factor to enable a sustained VC based project funding and financing process that can integrate community aspirations along with the project objectives (Jillella et al., 2014). The subsequent section details the transit impact of accessibility benefits on land values.

Transit Accessibility Impact Assessment on Property and Land Values

The key principle associated with VC is the unlocking of the increased land and property values based on increased accessibility value. The hypothesis is that urban rail transit driven accessibility improvements lead to gains in proximate land, property and rental values. In case of a subway it opens up new urban spaces with subway transit shopping or business places including public spaces below the busy streets and business districts. For all rail systems, the reductions in traffic increase the opportunities for other urban activities (especially knowledge economy jobs, see Newman and Kenworthy, 2015) and the ability to attract new urban development to make the most of improved accessibility. The gains are reflected in the generalized cost of travel as well as agglomeration benefits depending on a number of factors such as location, land use and density

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factors that are used to generate the economic value proposition for the transit system (McIntosh et al, 2011; 2014b).

The improved economic value of accessibility is internalized by businesses and residents so the relationship between the distance to a station and the property value is inverse and the value decreases as distance from a station increases. This has been validated through a nationwide survey conducted in the United Kingdom in April 2012 which showed that property prices within 500m of a railway station were 9% higher than similar properties away from the line. Further a similar study in Montreal in 2011 showed that property value had a 13% increase within 500m of a metro station, 10% within 1 km and 5% within 1.5km. A San Francisco Bay Area study found that for every meter a single-family home was closer to a Bay Area Rapid Transit station in 1990, its sales price increased by \$2.29 (Landis et al., 1994). Several research studies have demonstrated the impact of urban rail transit investments on property values (for example; Cervero & Duncan, 2001; Cervero & Landis, 1997). This assessment is, however, difficult when it comes to assessing the true value accrued due to the transit investments. The value of the uplift can vary due to a number of factors such as location, multi-modal presence, development concentration, density, property type, land use type and, of course, the assessment methodology used (Ewing & Cervero, 2010; Duncan 2008, Pan and Zhang, 2008). Furthermore, the variances in land value uplift can also be impacted by other issues related to the operation of the service and its surrounds, namely other issues such as noise, pollution and crime levels within the close proximity to the station (Diaz, 1999; Hui and Ho, 2004). In addition, Mohammad et al. (2013) observed lower land value uplift premiums in the car dependent North American and Australian cities compared to a higher uplift premium in the transit focused East Asian and European cities which have more patronage for public transport services. Research in Perth, Western Australia found an increase of 17% in residential land and over 50% in commercial land values around a suburban rail network but a new fast rail service to the south increased residential land values 42% in a five-year period beyond those in similar areas (McIntosh et al 2014a; Newman et al., 2013). Another study conducted in 1993 on residential properties adjacent to the 14.5-mile urban rail in Philadelphia, USA, using

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hedonic price models, recommended that access to rail created an average housing value premium of 6.4% (Voith, 1993). In an Indian study, it was noted that a decline in accessibility during the construction phases of several Metro projects due to increased dust, noise, congestion and air pollution, etc., had a huge impact on local businesses and residents adjacent to these project construction areas (Jillella et al., 2014). These studies all illustrate the challenge to estimate the true uplift value attributable to improved accessibility due to transit investments made among other local factors and the nature of the project.

There are several approaches have been used to estimate the transit impact on property values. The simple comparison method and hedonic price models are popularly used in a number of studies (for example; Cervero & Landis, 1993). The simple comparison method examines the relationship between land value or property price and transport accessibility by isolating transport accessibility from other factors through comparisons of land value/property price. The hedonic pricing method examines the relation-ship between land value and transport accessibility by standardizing a number of attributes in a multiple regression model with the dependent variable of land value. Martinez et al. (2012) further used a Monte Carlo simulation procedure to estimate synthetic population of residential and non-residential properties while evaluating the value capture potential of the Lisbon subway. In this study two simulation procedures were developed: one for the residential market and another for the non-residential market (commercial, office, industry, etc.). In another interesting study by Mohammed, et al (2012) a meta-analysis of the impact of rail projects on land and property values was conducted. Meta-analysis is a regression based approach that can be used to distinguish the main factors characterizing a range of studies.

The theory of how accessibility can impact on land and property values comes from original work by Alonso (1964). In more recent times it is explained by the bid-rent theory, which views the price that the consumer is willing to pay for a particular property as a decreasing function of distance to a certain attraction due to certain benefits realized from the attraction (McIntosh et al, 2014a). Banister and Goodwin (2011) identified three conditions needed for transport investment

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to spur economic growth: a buoyant economic environment, supportive political conditions, and sound decisions relating to the nature of the investment itself. The other value assessment methods include geographically weighted regression; direct differencing of land values; ratio and benchmarking analysis, etc., based on the data availability.

McIntosh, et al (2014a) provided a compilation of the transit induced value uplift academic studies. The majority of these are based on hedonic methods on land and property prices with respect to light rail transit, metro and commuter rail. These are given in Table 2.

Typically to estimate the impact of rail on land values the explanatory data parameters considered for the value assessment include: Land, House or Property, Neighborhood, Proximity to Transit, and Time-based variables. The most popular data variables to measure the premium value include:

Land: Lot size, land ownership or available public land;

Property/House: Focused on structural variables include built up area, number of bed rooms, bath rooms, and car parks, age of the building, building coverage ratio, floor area ratio, etc.;

Neighborhood variables include socio-economic parameters of the area, number of open spaces or parks, population density, employment density, percentage of differential land uses, road network within the area, crime rate, etc.; and

Proximity to Transit: Typically, proximity is measured from the perspective of walkability, or accessibility through cycling distance as measured less than 200m, 200m-400m, 400m-800m, 800m-1600m, etc. scales widely used. Adjacent properties tend to be for commercial and the rest predominantly for residential, employment or schools/hospital related facilities.

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Time based variables include land value price impacts during the announcement of alignment, pre-transit condition, during construction, post construction and transit operations phases indicate a dynamic land value changes impacted by transit. In most cases it was noted that the initial stages show a good jump from the pre-transit conditions generally due to speculation and marketing excitement from the developer community. Similar trends were observed from various studies post construction and initial operational phases.

Table 16 (2). *Compilation of transit induced value uplift academic studies*

	Author	Transit/Location	Dependent variable	Proximity Variable	Premium Rate
Light rail impact	Golub, et al., (2012)	Phoenix, USA Phoenix LRT	Land Adjusted Sale Price	200ft	25%
	Du and Mulley (2007)	England, UK Tyne & Wear light rail	House Price	200m	17.1%
	Cervero & Duncan (2002)	San Diego, USA LRT	Sale Price	400m	3.8% to 17.3%
	Hess and Almeida, (2007)	Buffalo, NY, USA LRT	Assessed Property Value	1/4 mile	2 to 5%
	Garrett, (2004)	Missouri, USA St.Louis Metrolink LRT	House Price	700m	32%
Metro/ heavy rail	Banister (2007)	London, UK, London Metro Jubilee Line	Land & Property Value	2000m	75%
	Laskso (1992)	Helsinki, Finland Helsinki Metro	Land Sale price	250m	3.5% to 6%
	Bae et al. (2003)	Seoul, South Korea Heavy Rail KoRail	Land (Sales Price)	400m	0.3% to 2.6%
	Yankaya and Celik (2004)	Izmir, Turkey Izmir Metro	Property Sale Price	500m	0.7% to 13.7%
	Medda (2011)	Warsaw, Poland Warsaw Metro	Property Sale Price	1000m	6.7%-7.13%
Commuter rail	Cervero and Duncan, (2002)	San Diego, USA Commuter Rail	Property Sale Price	1/2mile	-7.1% to 46.1%
	Gruen, 1997	Chicago, USA METRA Commuter Rail	Property Value	400m	20%
	Armstrong, 1994	Boston, USA Commuter Rail	Property Value	400m	6.7%
	Voith (1991)	Pennsylvania & NJ, USA Commuter Rail	Property Value	400m	3.8% to 10%

(adapted from McIntosh et al., 2014a)

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This section discussed the accessibility driven value proposition due to the transit investment on land values. The next section will discuss how to ‘capture’ the value created along with the various capturing mechanisms.

VC MECHANISMS TO CAPTURE THE VALUE

The main idea behind value capture is that urban rail will increase land values when it is built; this must be beyond what would happen anyway due to rising incomes and other economic activity. These land value increases can be captured by various government mechanisms and put into a Transit Fund that can then be used to raise finance for building and operating the rail system. Thus it can involve private sector financing (for building, owning and operating) as well as government sources of financing, but in all cases it will require a government funding mechanism to capture the value as the first step in unlocking the finance.

Capturing the value in an acceptable, transparent and equitable way involves multiple methods and complex mechanisms. There is no *one size fits all* solution possible. The applicability of a specific VC mechanism may or may not be applicable in another project due to a number of factors such as location, legislation, project type, willingness-to-pay, ease of adaption, administration, duplicity, etc., and these are all areas that need to be looked into on a case-by-case basis.

The most important way to categorize VC is into passive and active VC mechanisms. Active VC revenue sources are mostly revenue flows from active intervention such as buying property or creating a special levy on the station precinct; passive VC revenue flows are more asset value dependent so funds come from tax based revenue flows without intervention to actively pursue the value directly.

Active VC mechanisms can be applied to government owned property or vacant public lands

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which benefit from the transit accessibility driven increased land values. The said revenues can be accrued if governments either sell their land holdings or sell the development rights to the land holdings. In case of deep cut subway transit projects, the newly created underground space holdings around transit station area can yield more revenues through shopping or business activities as revealed in the case of subway projects of Hong Kong, SAR China, Japan and London.

The public transport financing practiced by Mass Transit Railway Corporation (MTR) in Hong Kong SAR, China and the Japan Railway Construction Agency (JRCA), a public corporation of Japan Railway are good examples of this active, development based approach. Hong Kong's MTR co-developed the sites along the transit corridors and above the transit station rather than selling those sites. In 1993, the corporation financed about 22% of operating cost of their transit system through property rental income. Similarly, the greater Tokyo's private railways have practiced transit value capture through development on an even grander scale, building massive new towns along rail-served corridors and cashing in on construction, retail and household service opportunities created by these investments (Suzuki et al., 2013, page 183).

Active VC mechanisms can include betterment tax, benefit area levies, infrastructure levies, special assessment districts, developer contributions, density bonuses or sale of air rights. In Australia the Gold Coast Transport Levy, which is collected across the whole of the Gold Coast municipal area, was used to help fund and operate a new light rail. The Transport Levy was able to provide the on-going costs of operation and was used to induce state and federal capital for building the system. A PPP was able to be used based on this active intervention to create a fund suitable to be used for raising the finance.

Passive VC mechanisms are mostly on private land where the revenue flow is focused through ad valorem tax instruments namely capital gains tax, stamp duty tax, land tax, GST on land sales and any other land-based taxes. These will rise due to the increased accessibility from the urban rail

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service and will flow into various levels of government. If scientifically estimated the increased flow of funding can be hypothecated into a Transit Fund and used to attract financing from banks involving various combinations of the private sector and government. Passive VC mechanisms still require government actions but not directly in the market place; they are therefore more politically acceptable. They do require Treasury Departments to hypothecate revenues. Both active and passive value capture can enable more significant private involvement in the urban rail projects. If private financing is being used it is possible to involve private consortia in a PPP where

not only do they bid to build, own and operate the rail system but they can also do entrepreneurial land development as part of their bid. In the case of private properties, a number of active VC mechanisms are available such as: development of private property or government land that has been specified to be part of the bid process; joint development of government land with the private sector; leasing the property for parking or development as fee based revenues; rental returns on government property; and leasing the space for other revenue. Thus, a combination of active and passive mechanisms could all be used to create the Transit Fund and hence create the financing opportunities for the rail project. Table 3 summarizes various VC mechanisms implementation as compiled in McIntosh, et al (2014, page 6) from various academic studies, and relevant secondary sources. A combination of active and passive VC mechanisms may work as a better approach to providing the best potential value proposition. The underlying success factor is that stakeholders are willing to pay provided they are convinced about the value proposition. Prior to the implementation of the VC mechanisms listed, each mechanism should therefore be required to be evaluated against an existing policy evaluation framework. This would include factors such as administrative ease of collection; legislation related challenges; socio-economic-demographic preferences; and political priorities.

The next section of this chapter describes a strategic value capture (SVC) framework approach to VC based rail transit project financing that would be possible to be undertaken across the transit project life cycle.

Six-Step SVC Framework for VC funded Urban Rail Transit Projects

It is a potentially more beneficial approach if the VC based funding and financing strategy is decided by the decision makers at the early stages of the project life cycle itself as a key objective.

Table 3. Compilation of VC mechanisms implementation from academic studies, and related websites

	VC Mechanism	Implementation & Transit	Comments
Passive Government Property	Sale of surplus property/development rights/air rights	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) • Washington DC, USA (Metro) • Sydney, Australia (Heavy Rail) 	These VC instruments can be used when vacant public land or government property is available and got transit proximity asset value increase.
	Sale of naming rights to stations	<ul style="list-style-type: none"> • New York, USA • Philadelphia, USA 	
Active Government Property	Direct development of government property	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) 	These are more induced VC mechanisms and maximize the returns on the government land or property available and also own the asset value.
	Joint development	<ul style="list-style-type: none"> • Hong Kong SAR, China (Metro) • Tokyo, Japan (Metro) • London, UK (Metro) 	
	Returns on public parking fee	<ul style="list-style-type: none"> • Portland, USA (Street car/LRT) 	
	Government property leasing	<ul style="list-style-type: none"> • Philadelphia, USA 	
	Advertising revenue at station areas	<ul style="list-style-type: none"> • Popular international practice 	
Passive Non-Government Property	Tax increment financing	Widely used in USA, UK & Australia	Primarily focussed on additional portion accrued due to increase in land values to the existing ad valorem taxes
	State transfer duty/sales tax	<ul style="list-style-type: none"> • Atlanta, USA (Heavy Rail) • Dallas, USA (LRT) 	
	State land/property tax	<ul style="list-style-type: none"> • Dallas, USA (LRT) • Portland, USA (Street car/LRT) 	
	Local government taxes	<ul style="list-style-type: none"> • Portland, USA (Street car/LRT) 	
Active Non-Governmental Property	Special assessment districts	<ul style="list-style-type: none"> • London UK (Metro) • Seattle, USA (Streetcar/LRT) • Portland, USA (Streetcar/LRT) 	These are integrated transit and land use development oriented VC mechanisms.
	Special area rates/service charges	<ul style="list-style-type: none"> • Atlanta, USA (Heavy Rail) • Dallas, USA (LRT) 	
	Infrastructure tax hypothecation	<ul style="list-style-type: none"> • London UK (Metro) • Portland, USA (Streetcar/LRT) 	
	Developer contributions	<ul style="list-style-type: none"> • Popular practice 	
	Density bonuses	<ul style="list-style-type: none"> • New York, USA (Metro) • Curitiba, Brazil 	
	Local parking levy	<ul style="list-style-type: none"> • San Francisco, USA 	

(adapted from McIntosh et al. 2014)

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The general findings from the various value capture experiences suggest one thing in common: that the VC based funding and financing process is a staged process. The proposed SVC framework described in this section offers a platform defining a VC based rail transit funding and financing development plan covering the planning, implementation and operationalization stages. This SVC framework offers a six-step strategic process across each stage of a rail transit project life cycle. These stages include: initiation; planning; design; funding strategy; execution; and operations. The six steps identified for the proposed SVC Framework across the six project stages with key VC processes identified are:

Step 1: VC Initiation: VC concept due diligence

Step 2: VC Planning: VC value proposition analysis

Step 3: VC Design: VC revenue capturing mechanisms

Step 4: VC Funding Strategy: VC fund redistribution plan

Step 5: VC Implementation: VC Governance

Step 6: VC Operations: VC Performance evaluation and monitoring

The remainder of this section details each of these steps.

Step 1: VC Initiation: VC Concept due Diligence

This stage is more like a due diligence phase on VC and builds on the normal transport planning processes but adds in a much more defined land use element. Firstly, the need for such investment and the problem it addresses needs to be determined. This will help justify the investment requirement and expected accessibility improvement. Secondly, a study is needed on the proposed corridor network with anticipated VC opportunities such as current densification, developmental opportunities, availability of vacant public land and also other accrued benefits from the development and also improved quality of life in the adjacent neighborhood. This will help from the perspectives of validation of VC potentials, and project impact zone. Primarily, the proposed VC catchment area is selected from considerations of transit accessibility and from the walkability and cycling perspectives, i.e. it is unlikely to go beyond 500m from the station area. In a few cases,

where alternate transit alignments are available, this will aid in determination of the transit network based on anticipated VC potentials. Further project stakeholders including the beneficiary community are identified and the objectives of the proposed project outlined. A macro-level qualification of the project for VC based funding and financing would be done during this step. VC due diligence can be included as a pre-project VC assessment study along with project feasibility or detailed project report preparation stages.

At the end of this Step 1, the following outcomes are expected:

- Need for transit established through problem definition.
- The best alignment with maximum anticipated VC potential is determined.
- VC catchment area as proposed transit project impact area identified as influence zone.
- VC stakeholders are identified.
- VC macro level goals defined.

Step 2: VC Planning: VC Value Proposition Analysis

This step involves defining the value proposition potential. Several studies need to be conducted to analyze the improved accessibility-driven transit impacts on land use and land values. Validation of the stakeholder opinion on the value proposition and assessment of their willingness-to-share the accrued unearned benefits anticipated through accessibility improvement need to be determined. During this step, the transit value proposition in terms of increased land and property values are analyzed, stakeholders are contacted and engaged in the process, and development strategies around the transit station areas are identified from the land use change or densification perspectives and also support infrastructure requirements from the sustainability and accessibility improvement perspective. This is a key step in the VC project life cycle which validates the value proposition of the transit project. At the end of this Step 2, the following outcomes are expected:

- Assessment of transit project impact on land and property values (a willingness to pay assessment).
- Assessment of active and passive VC potentials (assessed against criteria outlined above).
- Validation of stakeholder participation.

- Review the support infrastructure and other sustainability priorities around stations to support land development.

Step 3: VC Design: VC Revenue Capturing Mechanisms

Step 3 is an important phase in the process which focuses on how to translate the value created into monetary terms through appropriate VC mechanisms. This step identifies the revenue flows through various combinations of VC mechanisms. Revenue flows with induced land use strategies through integration of transit and land use are estimated and documented. Stakeholders need to be actively engaged in the process of selecting innovative alternate revenue flows. Care needs to be taken that sustainable development goals are kept in mind while finalizing the revenue streams. During this step, legislative measures and modalities as required are identified for implementing the recommended VC mechanisms as appropriate. The full set of funding potential raised needs to be specified. There will be some revenues that will flow immediately and some revenues will flow through the project life cycle as such as passive value capture from taxation revenues due to the on-going accessibility advantages of the rail system. The possible total amount that could go into a Transit VC Fund would be established. Such fund valuation potentials can act as security collateral to attract private sector financing through PPP or Joint Development methods as part of procurement decision. At the end of this Step 3, the following outcomes are expected:

- Passive and active revenue mechanisms identified and revenue generation plan finalized.
- Legislation challenges and ease of revenue capturing for identified VC mechanisms evaluated.
- Stakeholders engaged in the finalization of the VC mechanisms and modalities.
- VC fund prospects and revenue generation plan finalized.

Step 4: VC Fund Strategy - VC Fund Redistribution Plan

This is a very interesting phase for planners, stakeholders and decision makers as the VC fund redistribution strategies with stakeholder gain share model will be determined. The key strategic decision during this stage is focused on the captured fund redistribution strategies with proportionate share and ensuring the equity based revenue gain share strategies are finalized. The

redistribution of the captured value will be primarily through three complimentary strategies. First strategy is to give a major share to finance the investments made to build the rail transit project.

This may be with private or government approaches or a joint PPP approach but the key is to see how much of the VC Fund would be needed for the transit system financing. Second strategy is to share some revenues to boost the rail impact through local infrastructure. For example: improvement of access roads, pedestrian and bicycle parking facilities around the station areas covering the transit influence zone will bring more patronage to the transit and also sustainable infrastructure improvements will be made. This amount would need to be worked out with the local council and with the proponents of the rail system as well as the local stakeholders such as local businesses. Third strategy is to extend a partial benefit to the city community at large catering to the needs of their accessibility requirements. For example; equity issues may need to be considered to ensure those pushed out by the redevelopment process may be adequately compensated or provided with access to the station precinct by bus. At this stage, it is recommended to involve key stakeholders including community participation in finalizing these VC redistribution strategies. Participatory budgeting practices can be explored to ensure more accountability and transparency in the decision making. Once the strategies are finalized then a detailed activity based fund allocation plan could be determined.

At the end of this Step 4, the following outcomes are expected:

- Fund allocation strategies finalized and target beneficiaries identified.
- Eligible projects plan with funding stages finalized.
- Overall fund redistribution plan with multiple projects, targets and milestones detailed.
- Participatory budgeting options explored.

Step 5: VC Implementation: VC Governance

Now that the value proposition has been assessed and the VC mechanisms to capture the revenues are identified, this step is about translating plans and strategies into action. Step 5 mainly focuses on VC implementation mechanisms through establishment of institutional and administration set-up and strengthening with staff for activities to be undertaken. A core function will be establishing a Transit VC Fund within an institutional framework that can deliver the project. Such an

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institutional set-up can function as part of a project management authority but with a focus on fund collection and fund management as it may be best to deliver the project through a PPP. The procurement process needs to be specified to generate the kind of involvement from the private sector that is seen to be preferred for building, owning, operating and doing land development around the transit system. Governance structures are also needed for stakeholder participation and empowerment to steer the VC process to achieve the set objectives and goals. This can be required as part of a PPP. Execution of various VC mechanisms can be done on a collaborative basis through various participating agencies. Against each of the VC mechanisms a detailed implementation plan with administrative mechanisms and protocols is to be established. It is also essential to formulate transparency in the actions of fund collection and distribution. At the end of this Step 5, the following outcomes are expected:

- VC institutional and administrative setup established.
- Procurement process specified to enable private sector involvement.
- Executive body with stakeholder representation formed including transparent budget allocation plan.
- Stakeholder engagement and community empowerment plan.

Step 6: VC Operations: VC Performance evaluation and monitoring

This is a VC sustaining phase. Once the various VC mechanisms, institutional and administrative setup are put in place, the focus turns to monitoring and evaluation. Step 6 focuses on periodic review and continuous monitoring of fund flows and the effectiveness of the VC set objectives. During this stage the VC yield revenues flow back to recover the investments made, and also ensures appropriate fund commitments to the community at large are fulfilled. Leveraging software technologies, it is easy to define a VC based balanced score card approach with dashboard analytics to validate the VC governance strategy and performance on a continuous basis. The main emphasis is on understanding the performance of the various stakeholder groups against the set objectives and targets. From time to time it is advisable to have a check point to measure the effectiveness of the engagement performance and also evaluate any risk groups or dependent

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activities to be monitored. It is advisable to have a performance evaluation criteria and monitoring plan put in place in the initial stages of VC implementation for an objective evaluation. This is an ongoing process. As an outcome of Step 6, periodical performance metrics of VC implementation and fund management will be published and actions to review each of the Six Steps approach would be made.

The Six-Step SVC framework has been conceived on the principles of accountability and the utilization of a participatory approach. At the heart of this framework is the goal of achieving sustainable mobility and sustainable development along the proposed rail transit corridor.

FUTURE RESEARCH DIRECTIONS

Despite the good research progress made on VC based-financing approaches, there are many inadequacies in the current research in exploring the true potentials of VC based financing. In future, more focused research needs to be conducted on the delivery and implementation aspects of VC based project financing as this is where there is currently only limited knowledge available. Furthermore, research is needed to look at the effective institutional set-ups necessary, along with how participatory governance models can be utilized for an effective delivery of VC based rail transit funding and financing project implementation. In addition, there is limited research on the efficient VC fund redistribution strategies beyond simply recovering the rail transit investments made, and also on how VC can contribute to the place-making around the transit stations.

CONCLUSION

Urban rail transit is a major part of future urban mobility as there is a growing recognition and demand for more sustainable urban mobility linked in to the building of more sustainable land use patterns. Cities worldwide are facing a daunting funding challenge to build urban rail transit systems and there is a great need for innovative funding and financing mechanisms to enable these

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systems to be built and operated. Land based VC mechanisms offer a potentially feasible approach for financing urban rail projects in a way that enables more integrated, sustainable land use patterns. The general findings of the chapter suggest that transit investments if planned strategically with VC based approaches should help catalyze development opportunities along transit corridors and hence create access for more people without the need for a car. Therefore, integrating transit, land use and finance is a workable approach to achieve transit oriented sustainable development. It is evident from the chapter that VC concepts are here to stay in the future as a sustainable public transportation funding and financing solution.

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Journal Paper 2: Participatory Sustainability Approach to Value Capture-Based Urban Rail Financing in India through Deliberated Stakeholder Engagement

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**JOURNAL PAPER 2: PARTICIPATORY APPROACH TO VC USING
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Article

Participatory Sustainability Approach to Value Capture-Based Urban Rail Financing in India through Deliberated Stakeholder Engagement

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Abstract: Increasingly, cities around the world are seeking innovative financial mechanisms to build rail transit projects. Land value capture (VC) is a financing mechanism to fund urban rail transit. Often VC mechanisms are viewed only as a financing tool applied in relation to increased land values from the administration and legislation perspectives, without actively involving the community in the process. The lack of such participation has resulted in the under collection of the true value established. The transit beneficiary community and city tax payers are especially important stakeholders in this process as their willingness to participate is really critical to the overall VC success and transport outcome. This paper introduces a participatory sustainability approach to enable a more deliberated stakeholder engagement intervention across the VC life cycle. A four-step “Participatory Strategic Value Capture (PSVC)” framework is proposed offering step-by-step guidance toward facilitating a meaningful stakeholder dialogue, deliberation, and collaboration around the stated engagement interests. The PSVC framework, applied to the proposed Bangalore sub-urban rail project in India, has demonstrated the importance of stakeholder engagement using deliberated participatory approaches from a win-win perspective.

Keywords: value capture; deliberative processes; participatory sustainability; urban land values; rail transit funding; stakeholder engagement

1. Introduction

Cities across the globe have recognized rail transit systems as an emergent multi-functional solution to a range of urbanism challenges today [1–3]. However, most of them are struggling to find funds through traditional methods, and are seeking for alternate innovative financing solutions. Indian cities are no exception. Poor urban mobility can negatively impact the fast-emerging developing economies, such as India, where cities primarily form the epicenter for such growth. In this context, worldwide, monetization of urban land values through passive and active interventions is gaining attention as an alternate financing mechanism to fund urban rail transit. Cities in North America, Europe, Canada, Australia, New Zealand, and a few cities in Asia and Africa have opted for induced land value capture (VC) mechanisms as an alternate funding to build rail transit systems [4–6]. Land value capture refers to a type of innovative public financing, in which increases in land values generated by a new public infrastructure investment are all or in part “captured” through a land related tax or any other active or passive mechanisms, such as betterment charges, tax increment financing, air rights sale, property development, to pay back such an investment [7]. In other words, VC, in a broader sense, opposes the windfall gains derived out of public infrastructure creation accrued to a privileged few as unearned income, but argues for redistribution of such gains fully or partially to fund public investment and also to compensate social-costs often resulting from these investment negativities [8]. However, the VC concept is still perceived as a work-in-progress with varied success. As evident from these global experiences, this was primarily due to the fact that there is a notional misconception of the VC mechanism as only a financing tool [9,10]. The majority of these practices looked at the VC process only from the fiscal policy, administration and legislation perspectives. Often, VC is viewed as a tax tool or technique in the hands of planners, local governments, and investors, to fund infrastructure invested alone. Therefore, many of these practices lack clarity on the redistribution of the “captured” gains beyond recovering the transit investment. Mostly they have overlooked the needed support investments for infrastructure integration and the sustainable community living aspects [11].

In this context, stakeholder engagement has been recognized as a possible effective option to complement the VC process and move beyond being simply another tax tool to offer a powerful enabler for sustainable transit community development goals [9]. Whether as a resident with transportation concerns or as a user of transit, streets, or public spaces, a citizen’s opinion is vital in helping define the VC process from planning to implementation [12]. Both the transit beneficiary community and the city taxpayer community are potential key stakeholders in defining the VC process. Recently, a few cities in India have attempted to tap urban land values as an

alternate funding source for urban infrastructure using new financial instruments like impact fees, higher Floor Area Ratio (FAR) sales, auction of public properties, and mostly structured them as a one-time charge collected to partly pay toward public infrastructure required by new developments. The majority of such initiatives have limited the community participation either to information sharing or to consultation approaches only [13]. Moreover, the lack of participatory approaches in the VC process has led to an under-assessment and/or under-collection of the true value established and have been unable to fully explore the true potential of actual value created [11]. Smolka [14] reiterates that citizen or community engagement in service and policy design is not only the right thing to do but will also provide a rich source of ideas to the government. Community and local businesses are especially important external sources of ideas as they form the beneficiary user group and directly feel the impact of the stated public investment and services. The success of VC, thus, depends on community engagement and their willingness to participate in the process. Hence a participatory sustainability approach to the VC process is needed to engage with the stakeholders as partners in the process rather than as mere actors in the process.

Uncertainty remains about how to do VC-based stakeholder engagement, when it should commence, the methods that should be used and which members should be consulted. In practice, stakeholder engagement is not a simple task as many stakeholders are disengaged, especially when certain groups within the population are marginalized [15]. Of late, Deliberative Democracy (DD) techniques seek out how community engagement in decision-making can find broad support from all key stakeholders, especially the general public, for a policy direction [16]. To this end, a participatory route utilizing deliberative methods is regarded as the most effective process that will enable positive outcomes. This is the goal behind the participatory sustainability approach in VC context examined in this paper.

The paper sets out how to do a participatory sustainability approach within a VC context, from planning to implementation stages, using deliberative consultation approaches. It provides a four-step “Participatory Strategic Value Capture (PSVC)” framework, offering step-by-step guidance to interventions along with providing various approaches of undertaking stakeholder participation across the VC life cycle. The PSVC framework proposes a deliberated stakeholder engagement method using various DD techniques that are relevant in a VC context to help facilitate a meaningful deliberation to enable the co-creation of an inclusive and context specific VC strategy. This paper describes the application of the PSVC framework in the context of defining VC-based financing for the proposed Bangalore sub-urban rail project using high quality DD techniques. The paper first introduces a participatory sustainability approach within a VC context, proposes the PSVC framework, and then describes its application in Bangalore to examine the benefits of

utilizing participatory approaches in defining a VC process. It then assesses whether this PSVC framework has the potential to assist other cities worldwide looking to undertake a VC process to deliver public transport involving stakeholder engagement.

2. Background to Participatory Sustainability Approach in a VC Context

2.1. Need for Participatory Stakeholder Engagement in a VC Context

Holmes (2011) [17] (p. 13) states that “engagement is not a single process or set of activities. It is an ongoing process or conversation that builds trust and relationship”. The Organization for Economic Cooperation and Development (OECD) [18] (p. 30) classify stakeholder engagement into three forms of engagement: information sharing, consultation, and participation. The first level, “information sharing” is basically a one-way communication approach where information is passed from the decision makers to the stakeholders. The second level, “consultation”, is where stakeholders are able to feed into parts of the decision-making process, but are not able (or empowered) to ensure that their aspirations were taken into account. The third level, “participation”, enables stakeholders to be involved in the decision-making process [18]. The participatory route with deliberative democratic approaches is regarded as a much more influential process to have positive results. This engages randomly selected people from the general public as well as stakeholders so it can create engagement or collaboration or empowerment forms of participation [19]. Many successful community engagement experiences envisage that having the general public and stakeholders engaged at the helm of the policymaking process transforms them as an agent of change and co-creator with a systematic pursuit of sustained collaboration [14,19]. A participatory approach, therefore, demands a major paradigm shift in the thought processes of government agencies and community. Furthermore, engagement processes require stakeholders to acquire specialized skills in order to have a successful collaboration. For example, Holmes (2011) [17] (p. 1) highlighted that government or public agencies may be required to develop new roles as enablers, negotiators, and collaborators, and, at the same time, the community may be required to demonstrate a willingness to be actively engaged in the process (and dedicate time to the process) along with being sufficiently well informed to enable their participation and deliberation to be effective.

Overall, the expected benefits from stakeholder engagement utilizing a participatory sustainability approach within a VC context includes generating good will, removing uncertainty, and enabling community expectations to be at the forefront of decisions, amongst other benefits.

Furthermore, it provides an opportunity to receive stakeholder support in the initial stages of the process and participation from the community helps to enable democratically agreed VC fund redistribution strategies. If such agreement happens, it can help to enable the captured value to be re-distributed proportionately to related community support systems, along with the transit investment that was necessary to enable the transit to be built. Primarily, the participatory sustainability approach actively facilitates community and stakeholder involvement in decisions that affect them directly. However, in practice, undertaking stakeholder engagement in a democratic dialogue is essentially a multifaceted and multi-dimensional challenge [20]. The literature on stakeholder engagement emphasizes the need for community engagements to be far reaching, inclusive, balanced, and facilitated through a democratic dialogue [21].

2.2. Role and Techniques for Deliberated Participatory Stakeholder Engagement in a VC Context

There is no single tool or technique to influence successful stakeholder engagement, but a combination of several tools are used to enable the desired engagement outcomes. Different people or communities prefer different engagement methods, and some methods work better for some activities than others. The determination of which technique is the right technique is influenced by several factors, namely: set engagement objectives; desired outcomes; type of engagement; stakeholder types; level of engagement; socio-politico-cultural environment; time, cost and skill set available; and the stage of project progress [22] (Whichever method is selected, it is worthwhile to consider access for all people or communities of interest, including hard-to-reach groups. The commonly used technique across different levels of the stakeholder engagement process, as prescribed by the quick method selector of Bolton's Community Engagement and Consultation toolkit, include publicity campaigns, and exhibitions and road shows are common for information-sharing purposes; focus groups, surveys (self-completion, telephone, or face to face), citizens panel, advisory committees, feedback and suggestions, website based inputs, public meetings, are popular during stakeholder consultation stage; ward councillor contact or user panel for citizen involvement stages; community needs analysis, citizen juries, and visioning workshops, are advised for the collaboration stage [22] goes beyond these techniques to ensure there are not just stakeholder but randomly selected citizens who can ensure meaningful participation with inclusiveness, deliberation, dialogue, and acceptable consensus [23]. To this end, DD is an established approach that provides a powerful and effective way for communities to collaboratively problem solve and co-create sustainable outcomes together with decision makers and technical experts. Carolyn and Lars (2006) [24] (p. 20) state that DD advances richer forms of

public participation that engage citizens in a structured dialogue around focused policy issues, and yields benefits to participants and sponsors that extend beyond the collection of useful information.

Carolyn and Lars (2006) [24] (pp. 24–25, 31–32) recommended eight DD techniques to integrate public deliberation into agency decisions, namely; “ChoiceWork Dialogue, Citizens Jury, Consensus Conference, Deliberative Polling, Issue Forums, Study Circles, 21st Century Town Meeting, and Citizen Assemblies”. These approaches seek to find “broad support” from all key stakeholders as well as citizens for a policy direction. Similarly, Hartz-Karp (2013) [25] (pp. 45–90) suggests seven DD techniques that are suitable for a participatory sustainability approach to enable interactions, dialogue and ideally deliberation between all stakeholders. The DD techniques recommended as suited to facilitate the VC based stakeholder engagement process are selected from Hartz-Karp (2013) [25] (pp. 111–119) and are detailed below:

- (1). *Consensus Forum*: This is a popular deliberation process in aiding shared understanding and meeting consensus in a complex and difficult decision making situation, where a variety of stakeholders namely, public, private, resident community, and civic societies are involved in decision making. This technique is particularly useful when the participants are greater in number and representing divergent views on more intricate issues, or most argumentative issues as the approach aids the consensus-based decision-making process.
- (2). *Multi-Criteria Analysis (MCA)*: The MCA technique is a structured iteration-based deliberation technique, leveraging scientific data and technology to help the decision-making process. This technique is a means of simplifying complex decision-making tasks, which may involve many stakeholders, a diversity of possible outcomes, and many, and sometimes intangible, criteria by which to assess the outcomes. This tool would help to prioritize a set of options identified with appropriate weightages assigned, and rank them based on the pre-set deliberation objective.
- (3). *World Café*: This technique offers a simple, effective, and flexible format for hosting large group dialogue using participatory rounds of shared interactions especially in joint visioning, planning, and designing context, to motivate networked exchanges in smaller group rounds. In this approach, participation is only by invitation, based on the purpose of the meeting. World cafés can be used across a specific issue or multiple issues, where people engage in progressive rounds of conversations ascertaining questions related to a particular issue in each cluster.
- (4). *21st Century Town Meeting/Dialogue*: This technique is a software enhanced public deliberation forum with near real-time outputs and priorities generated. This technique is

more useful to conduct with a large group deliberation, and provides instant feedback. Participants are linked through online networked computers, and engage in informed deliberation in smaller groups through real-time feedback and deliberation to find common themes and priorities on most contentious issues. This primarily seeks substantive feedback on key issues, finding common ground, and to prioritize what is most important toward influencing decision-making.

- (5). *Open Space Technology*: The Open Space Technology meeting is to create time and space for people to engage deeply and creatively around issues of concern to them. Later, an open circle meeting is reconvened, where all participants can give their comments as part of a facilitated process. This is followed with a final plenary session where participants can give comments and, finally, it provides the outcome with a common understanding on defined goals, actions, milestones, and responsibilities with a way forward.
- (6). *Local Area Forum*: This technique is popular to bring together government, industry, and community to determine the optimal use of scant resources through coordinated actions and joint collaboration. It is more representative of the local community and can get greater local ownership of issues. In this method, local community is more involved and empowered to make informed decisions on what the community requires.
- (7). *Strategic Questioning*: This is a powerful problem-solving technique to engage groups in innovative thinking, to develop strategy, to facilitate change, and to gain acceptance to new ideas. Strategic questioning as a tool helps to find creative ways in times of uncertainty, conflict and confusion, and in case of current thinking, appears to be constrained.

The set of DD techniques provide a powerful and effective way for communities to engage and co-create more consensual policy decisions with communities, public sector decision-makers and other “experts”. The deployment of appropriate techniques will depend on the engagement objectives, such as understanding stakeholder expectations, assessing levels of participation interest, and other interconnected objectives [26]. Deliberative forms of democratic decision-making help increase the level of responsibility that citizens take for their own actions and behaviors. Participation also gives stakeholders an opportunity for social learning by hearing the views of other stakeholders, talking through the range of possible solutions, and comparing the impacts of various alternatives in terms of their collective short-term and long-term interests

2.3. Review of Best Practices for Participatory Stakeholder Engagement in a VC Context

Worldwide, there are many notable public participatory approaches in practice for community engagement in decision-making, which seeks to find broad support from all key stakeholders for

a policy direction. This section highlights a few of such best practices that could be applied to the issue of monetization of urban land values for financing urban infrastructure. In the late 1990s and early 2000, a new form of civic participation model, Community Benefit Agreements (CBAs) became popular in urban redevelopment practice and to claim public subsidies by developers in North America. Musil [27] (p. 829) defines the CBA process as “a developer enters into a private contract, usually with a coalition of community, faith-based, or special interest groups in exchange for their support, cooperation, or forbearance regarding the proposed development”. More importantly, the developer is interested in such support before approaching agencies for formal approvals and regulatory changes. Typically, CBAs are independent agreements between a developer and negotiating parties, with or without a formal government role as a facilitator. Advocates of CBAs aim to insert local stakeholders, typically low-income households in the vicinity of development project, directly into the process of recovering the value. They are expected to drive for accountable development by involving communities in formulating, or to arrive at negotiated deal-specific CBAs on the sharing of the value of the resulting development. Wolf-Power (2010) [28] (p. 142) states that, often, the participants in a CBA negotiation are neighbourhood groups from the area surrounding the development site, and regularly working in coalition with advocates for affordable housing, environmental quality, and workers’ rights. Typically, such negotiations centre on democratic deliberations, participation and in the pursuit of shared social objectives. Overall, deal-specific CBAs are anticipated to remove project uncertainty with local support that produces positive results for the project. However, Wolf-Powers [9] (p. 217) stated that CBA is perhaps the most controversial among the various VC mechanisms and there exists a dual perspective on CBA Musil [27] (p. 842) cited that there were about 30 CBA-based projects in USA as of 2012, and few states have CBA regulations in place. This paper briefly reviewed the findings of the Musil [27] pilot study of various CBAs with particular attention to two CBAs namely; Atlanta Beltline CBA and Gates-Cherokee CBA. The former CBA is about the Atlanta Beltline light rail track around the city, and appropriate area redevelopment along the corridor through creation of a tax allocation district, whose revenue will fund redevelopment area improvements. The latter CBA is about the demolition and redevelopment of the abandoned Gates Rubber factory site into a retail space and housing, with an emphasis on local hiring, affordable housing, and with various other community benefits.

The study highlighted that CBAs are often criticized, as they are negotiated from a limited community perspective because they represent only the views of the CBA coalition and do not reflect the needs of the broader community. Therefore, issues of community identification in CBA negotiation are at the forefront of the shortcomings identified in the study. Further, these studies also revealed the key issues as: constitutional validity of CBAs with respect to issues on process,

enforcement, and protection of the agreement; enforcement related binding of contract issues; and CBAs' compliance in the context of existing property laws on land use regulation and planning processes. The Atlanta Beltline CBA is in the context of constructing a 22-mile light rail transit loop around the city of Atlanta, and aimed for financing partly through a 6500-acre tax-allocation district (TAD). The TAD functions by diverting the difference between the baseline taxes and the increased tax increments to repay the municipal bonds issued to finance the Beltline. Though the project created good interest, it was faced with concerns on gentrification and the displacement of residents. While there is no Beltline CBA coalition, the project is being managed in such a way so as to provide enhanced opportunities for public input and a number of community benefits across Beltline projects. Common community benefit principles, included: prevailing wages for workers; a "first source" hiring system to target job opportunities for residents of impacted low income 'Beltline' neighbourhoods; and establishment and usage of apprenticeship and pre-apprenticeship programs for workers of impacted Beltline neighbourhoods. The City Council approved, with community input and involvement, a number of benefits, including living wages, local hiring and training programs, affordable housing, environmental remediation, and funds for community programs. Been [29] (pp. 34–35) alleged, citing Atlantic Yard CBA, that developers forged a CBA with self-interested supporters, while excluding groups pushing for modifications to the project plan, and even claimed revision to a higher subsidy package. Even in the case of Denver's Gates-Cherokee CBA, issues were found to be the differences of opinion on the definition and legal standing of CBAs. This is a clear case of a CBA that ended as a memorandum of understanding with a slate of commitments for community groups, without any legal binding on the defaulters. There is varied success with respect to private CBAs and public brokered CBAs as a facilitator, and it can be further concluded that a CBAs outcome depends on interest-group politics versus democratic public participation approaches [27]. Further, a lack of formal process to negotiate CBAs, lack of structure for public involvement, difficulty of preset timelines for CBA negotiations, and an overall weak structural process for CBA negotiation, are a few key issues of concern for CBA success. Another such example, popular in Europe in the context of Garden Cities and New Towns, is the strategic land and infrastructure contract (SLICs), to ensure infrastructure delivery through land value capture. The SLIC concept is to secure delivery of infrastructure using land value capture and voluntary land pooling. Typically, SLICs include a contract between land owners or developers, local authorities, and government agencies [11].

Though CBAs and SLICs are driven by a participatory approach in the pursuit of equity and accountable development, they are threatened by the risk of creating local lobby groups and interest-group politics. The critical success factors, which are significant in such approaches, include ensuring deal transparency, community empowerment, accountability, political

commitment, inclusive governance, and, most of all, public legitimacy. In this context, VC-based community engagement practices of the North American cities, especially of practices in the context of public transportation in the city of Portland, are worth mentioning. Portland has a history of over 40 years of strong community governance through an established city-wide neighbourhood association system and commitment to citizen participation processes at various levels, as part of its pursuance of city-sustainability goals.

The Oregon state-level-enabling legal environment, coupled with the Portland local government commitment to broad-based community participation, enabled the implementation of system-development charges through tax-increment financing (TIF), special assessment districts (SADs), and transit impact fees [30]. Portland has used local improvement districts (LIDs) as funding sources to help finance all phases of the Central Streetcar Project. Community participation also played a key role in the success of the LIDs, and Portland is probably among the first cities in USA, since the 1970s that recognized the importance of community engagement and sustainability goals [31]. The city consulted the community, businesses leaders, and interest groups, involving them while developing their Light rail. The city consulted the stakeholders prior to the LID formation, thereby securing their strong support throughout the project. Furthermore, it revised assessments whenever mistakes were made in the assessment calculation process. In the Phase 1 and 2 LIDs, the city averted a potentially contentious political battle by exempting owner-occupied residential properties from paying assessments [31] (p. 92). Furthermore, the city was able to work with the stakeholders to find solutions when problems arose. For example, those living outside the underdeveloped North Macadam urban renewal area (URA) were initially concerned that their funds would be used to subsidize it. The city addressed this concern by creating the North Macadam Overlay, which helped specify the geography of where the URA funds would be expended [31,32]. Behind the successful collaboration of the Portland experience there exists strong governance and institutional capacity to garner the support of the community and public agencies at the time of the TIF-district formation. David [32] (pp. 1–2), while appreciating Portland’s “coordinated key stakeholder” strategy in their neighborhood community approach, stated that neighborhood leaders successfully persuaded property owners on each leg of the streetcar route that they should support taxes on themselves to pay a major portion of the front-end capital investment. However, this paper suggested that, though Portland has been working on its street car system for the last 30 years, it is only now learning how to fully recoup their operating expenses. Further, Portland has seen unbridled gentrification of the downtown area, and is still struggling with providing needed affordable housing options throughout the city. This was primarily due to the fact that neighborhood associations failed to pay attention to the voice of the

under engaged, the people of color or immigrants. This realization led to the initiation of the Community Connect initiative, involving diverse groups, into deliberations.

The case of Portland revealed some conflicts over VC: resident stakeholder groups could oppose SADs, while the business community were generally willing to pay for assessments charged. Therefore, several SADs, formed to fund Portland Streetcar, exempted residential property owners from paying assessments in order to pre-empt opposition from them [31]. Some states in the US required voting on SAD formation, as per local and state legislation. In such cases, extensive community outreach programs or campaigns were required in large residential neighbourhoods to educate them on the transit benefits, or simply to exempt them from paying property tax [32]. Different experiences from U.S. cities suggest that the best approach for coordinating stakeholder input will depend on the objectives for the transit corridor, corridor type, local context, and regional conditions [31].

Overall, the key lesson from these experiences is that early engagement of the key stakeholders, involving the local residents, neighbourhood organizations, real estate developers, and small business owners, alongside transit agencies and city or county government in the project life cycle, can yield productive collaboration and coalition-building. The importance of high-level political support, proper legislation, and inclusive governance are keys to build trust and make a difference to the success of community engagement. For example, Oregon state-enabling legislation, and its authoritative sponsorship of the process and openness to input, bolstered the credibility and effectiveness of community collaborations, negotiations, and recommendations [33,34]. Community outreach, seed money grants, work opportunities, faster implementation timelines, committed leadership, local champions; and deployment of skilled neutral facilitators are critical to sustained collaboration [34].

The PSVC framework presented in this paper is inspired from such community engagement experiences and best practices in the context of emerging cities that are and focused on a strategic VC-perspective.

2.4. Need for a Participatory VC Stakeholder Engagement Framework for Cities in Developing Countries

Many cities in developing countries are still at a nascent stage of understanding and in implementing innovative practices like deliberative forms of democracy and VC-based financing, especially in building urban rail transit systems. In India, more particularly, after the 73rd and 74th amendments to the Indian Constitution, the decentralized governance framework has introduced a new dynamic into the overall process of participatory democracy [35]. In 2011, the Government

of India issued an advisory to cities on exploring monetization of urban land values through innovative financing mechanisms to build urban transit infrastructure projects. Few cities across India have attempted tapping urban land values such as introducing impact fees, higher floor-area-ratio (FAR) sale, toll fees, auction of vacant public properties, betterment charges, and joint development of open areas, in the context of rail transit, BRT, highways development, and town planning schemes. There is little evidence of any broad-based active community engagements beyond administrative consultations or information sharing, while implementing such charges resulted in small, one-time charged tax revenues [13,36,37].

The majority of cities, especially in developing countries, have not yet fully explored the possibilities of a participatory approach to VC with a strategic planning perspective. Interestingly, there is definitely a drive among them in realizing the advantages of such practices [36]. What is lacking, however, is a keen understanding of VC process-oriented methodology or strategic engagement framework guidance with various planning interventions across the VC life cycle. To bring all stakeholders to the same level of understanding and consensus building regarding the problems and potential solutions for the transit corridor based development requires a significant amount of skills, knowledge sharing, flexibility, empowerment, and time to be spent [37]. This demand facilitated policy development, mediated negotiations, sustained collaboration, and productive stakeholder involvement. This raises many questions and concerns regarding implementation, which include: who are the key stakeholders to engage with, what are the objectives of such engagement, what are the appropriate engagement techniques and models to be used, how to encourage participation and ensure commitments, and how do we monitor the effectiveness of such engagement.

The PSVC process framework proposed in this paper is conceived to address such concerns and is based on the good practices which already exist and are packaged into a focused end to end strategic framework across the VC life cycle from planning to implementation in an urban rail transit context.

3. VC Process Life Cycle

Worldwide, many cities have implemented VC-based infrastructure-financing options in a stage wise process, but have differed in the adoption of VC mechanism strategies. These stages can describe the process of the VC-based transit funding project life cycle, from planning to implementation. The entire VC process is classified into six stages: initiation, planning, design, strategize, execution, and operation. The participatory sustainability approach recommends

engaging stakeholders across all six stages of the VC process life cycle. These stages are predominantly the same in any VC-based project, however, the key processes followed within each stage may vary slightly. This can be further explained. For example, the first stage is “initiation”, which is the conceptualization phase where the possible transit network, alignment options, land use, legislation, and regulation perspectives are considered. Similarly, the second to fourth stages, “planning”, “design”, and “strategize”, include the process of defining and structuring the VC for the transit project. Indeed, the actual process of VC planning, design, and strategizing kick off during these phases. The last two stages of the VC life cycle, “execute” and “operate”, drive the VC implementation and VC operationalization. The key processes of VC, across each stage for any urban rail transit project, are illustrated in Figure 1.

VC Life Cycle Stages	VC Focus	VC Processes
1 Initiation:	<ul style="list-style-type: none"> VC Concept 	<ul style="list-style-type: none"> Need and Problem definition Project Objectives Transit Network feasibility Legislation and regulations
2 Planning:	<ul style="list-style-type: none"> VC Planning 	<ul style="list-style-type: none"> VC catchment identified Transit beneficiary analysis Land value impact analysis Stakeholder groups identified
3 Design:	<ul style="list-style-type: none"> VC Design 	<ul style="list-style-type: none"> VC funding assessment VC mechanisms identified Sustainable development focus Transit-Land Use Integration
4 Strategize:	<ul style="list-style-type: none"> VC Strategies 	<ul style="list-style-type: none"> Value proposition defined VC Fund structure established Stakeholder gain share model Value redistribution focus
5 Execute:	<ul style="list-style-type: none"> VC Implementation 	<ul style="list-style-type: none"> VC implementation tools Fund management Organizational focus Accountable transactions
6 Operation:	<ul style="list-style-type: none"> VC Governance 	<ul style="list-style-type: none"> Start payback to investment Redistribution to community Monitoring & evaluation Periodic revisit to VC model

Figure 10 (1): VC stages, key VC focus, and key VC processes across the VC life cycle.

Now the challenge is how to apply the stakeholder engagement strategy across the VC life cycle. The participatory approach to VC is more like creating and articulating transit impact on land value gain, and sharing the gain, involving all stakeholders in a win-win strategy for the

community at large. Such stakeholder engagement shall rightfully begin from the infrastructure-investment planning phase, and jointly identify numerous ways of creating value and, then, to conceptually deliberate the means to capture from such gains. The following section will detail the PSVC framework to enable the stated participatory sustainability approach in a VC-based urban rail transit funding context.

4. Participatory Strategic Value Capture (PSVC) Framework

The PSVC framework offers a platform from which to undertake a stakeholder engagement process in VC-based rail transit financing projects. This framework requires the participation of all stakeholder groups at various stages of the VC process life cycle. This means involving stakeholders in all stages of the process, from the initial defining of the VC process, which is to be used for the operationalization of the project on a continuous basis. The PSVC framework is envisioned to provide a common path to dialogue and deliberation among key stakeholders, mutually acceptable resolutions, community aspirations and needs. This means that when value creation and capturing are facilitated from development proposals that build urban rail transit systems then at the same time they should enable sustainable station neighbourhoods. The PSVC driven participatory approach to VC-based project funding is to help improve trust, negotiation, and dialogue between different stakeholders, and to build a broader ownership of the VC process with commitment. The key success factors to achieve a successful PSVC-driven stakeholder collaboration include:

- Broad based community participation is enabled
- Effective communication and commitment is created
- Concurrence on shared goals, value created or expected
- Strategic, independent, adaptive and transparent approaches are developed
- Building trust among stakeholders through being inclusive
- Unbiased engagement objectives and plans are set upfront
- Equity in value redistribution is given due importance
- Sustainability goals are incorporated along with transit goals
- Transit station neighbourhood aspirations are aligned with the project
- Conflict management processes are set up
- Stakeholder capacities are strengthened to enable adequate engagement
- Compliance with the city priorities, policy framework and legislation is enabled

Thus, the PSVC framework focuses on that designing of processes that facilitates value creation learning, deliberates on value redistribution and promotes joint action to determine agreed multiple

VC-based outcomes. These needs to simultaneously suit transit funding and also neighbourhood revitalization. Essentially this provides a framework and a strategic forum, offering step-by-step guidance to the participatory approach identifying various interventions across the VC life cycle to fund and finance urban rail transit systems, rather than being applied in context for a particular VC tool. The proposed PSVC framework is comprised of a sequential four-step stakeholder engagement model:

- Step 1: Identify Stakeholders
- Step 2: Set Engagement Objectives
- Step 3: Select Engagement Techniques
- Step 4: Monitor Engagement Performance

Each of these steps will be described in detail in this section.

4.1. Step 1: Identify Stakeholders

Step one involves identifying and classifying the necessary project stakeholders at the onset of the project. The next step is to classify the identified stakeholders into specific groups based on their interests in the project. In a VC-based transit financing project context, we can broadly classify the stakeholders into three major groups: investors, wind-fall beneficiaries, and city community [37,38]. The three major stakeholder groups for an urban rail project, along with the stakeholders that could be included in these groups, and their aspirations, are illustrated in Figure 2.

Group	Stakeholders	Aspirations
Investors	<ul style="list-style-type: none"> ▪ Public agencies ▪ Private sector ▪ Local Bodies ▪ Railway agencies ▪ Donor agencies 	<ul style="list-style-type: none"> ▪ Build infrastructure ▪ Improved productivity ▪ Return on investment ▪ Regulations & budget ▪ Sustaining operations
Wind-fall Beneficiary	<ul style="list-style-type: none"> ▪ Land owners ▪ Real-estate ▪ Developers ▪ Businesses ▪ Govt. (vacant land) 	<ul style="list-style-type: none"> ▪ Land values appreciation ▪ Windfall gain ▪ Speculation ▪ Private developments ▪ Land banking
Community	<ul style="list-style-type: none"> ▪ Local residents ▪ Local businesses ▪ Low-income group ▪ Civic societies ▪ Precinct community 	<ul style="list-style-type: none"> ▪ Improved accessibility ▪ Improved commuting ▪ Improved business ▪ Value shareholders ▪ Sustainable mobility

Figure 11 (2) VC-based urban rail financing project stakeholders and their aspirations.

The first stakeholder group is the “Investor” group. These are the stakeholders who provide the capital or investment in the project. They, along with providing a public good, also require a return on investment. The “Wind-fall Beneficiary” group are those who benefit by the delivery of the project, generally through their proximity to the project, and with urban rail projects, from the increased accessibility, the increased property values, increased rents, agglomeration of new economies, and land use changes, that happened due to the implementation of the rail project. The third group, the “Community” group, includes the local community members with direct access to the project, particularly the low-income community groups within the vicinity, and the city tax payer community at large [11,36]. Understanding the aspirations and cross-sectorial objectives of these groups provides a solid platform to be able to define the appropriate VC process to be undertaken.

4.2. Step 2: Set Engagement Objectives

The second step involves defining the stakeholder engagement interventions and objectives across the VC life cycle as shown in Figure 3.

VC Life Cycle	VC Key Processes	Engagement Objectives
1 Initiation: VC Concept	<ul style="list-style-type: none"> • Need and Problem definition • Project Objectives • Transit Network feasibility • Legislation and regulations 	<ul style="list-style-type: none"> • Information sharing • Public workshop • Need validation • Consultation
2 Planning: VC Planning	<ul style="list-style-type: none"> • VC catchment identified • Transit beneficiary analysis • Land value impact analysis • Stakeholder groups identified 	<ul style="list-style-type: none"> • Deliberation • Willingness to Pay • Commitment • Participation
3 Design: VC Design	<ul style="list-style-type: none"> • VC funding assessment • VC mechanisms identified • Sustainable development focus • Transit-Land Use Integration 	<ul style="list-style-type: none"> • Deliberation • VC Instruments • VC Incentives • In Steering Group
4 Strategize: VC Strategies	<ul style="list-style-type: none"> • Value proposition defined • VC Fund structure established • Stakeholder gain share model • Value redistribution focus 	<ul style="list-style-type: none"> • Deliberation • Entrusting community • Accountability • Responsibility
5 Execute: VC Implementation	<ul style="list-style-type: none"> • VC implementation tools • Fund management • Organizational focus • Accountable transactions 	<ul style="list-style-type: none"> • Inclusive governance • Deliberation • Engagement • Transparency
6 Operation: VC Governance	<ul style="list-style-type: none"> • Start payback to investment • Redistribution to community • Monitoring & evaluation • Periodic revisit to VC model 	<ul style="list-style-type: none"> • Deliberation • Review & evaluation • Sustainability focus • Benefit assessment

Figure 12 (3) Stakeholder engagement interventions across the VC life cycle.

The engagement objectives need to be defined across all the six stages of the VC life cycle. The initial stage is more of a conceptual stage. Therefore, the set engagement objectives at this stage could include information sharing, communication of project goals, the elicitation of community views, validation of the problem, and determining the anticipated value addition through consultations. Similarly, stakeholder engagement objectives during the second, third, and fourth phases would involve participation, deliberation, and co-creation from all groups, as identified above, and involves deliberating and agreeing on the various VC mechanisms to be utilized. The last two stages of the VC life cycle drive the VC implementation and operationalization. During these last two VC stages, the set engagement interests are primarily collaboration, engagement, and empowerment through active participation in project steering groups and governance in order to ensure the set project objectives are achieved.

4.3. Step 3: Select Engagement Techniques

The third step facilitates the undertaking of stakeholder engagement by identifying appropriate engagement techniques that could be used across a VC life cycle. Primarily, this step focuses on establishing which engagement techniques might work best in each stage of the VC life cycle. DD techniques cross referenced with VC life cycle and engagement objectives are shown in Figure 4.

VC Life Cycle Stages	Engagement Objectives	DD Techniques
1 Initiation: VC concept	<ul style="list-style-type: none"> Information sharing Public workshop Need validation Consultation 	<ul style="list-style-type: none"> Consensus forum World Café
2 Planning: VC planning	<ul style="list-style-type: none"> Deliberation Willingness to Pay Commitment Participation 	<ul style="list-style-type: none"> 21st Century Dialogue Open Space Technology Multi Criteria Analysis
3 Design: VC Design	<ul style="list-style-type: none"> Deliberation VC Instruments VC Incentives In Steering Group 	<ul style="list-style-type: none"> World Café Open Space Technology Multi Criteria Analysis
4 Strategize: VC strategies	<ul style="list-style-type: none"> Deliberation Entrusting community Accountability Responsibility 	<ul style="list-style-type: none"> Local Area Forum Consensus Forum Multi Criteria Analysis
5 Execute: VC Implementation	<ul style="list-style-type: none"> Inclusive Governance Deliberation Engagement Transparency 	<ul style="list-style-type: none"> Strategic questioning Local Area Forum Open Space Technology
6 Operation: VC Governance	<ul style="list-style-type: none"> Deliberation Review & Evaluation Sustainability focus Benefit assessment 	<ul style="list-style-type: none"> World Café Open Space Technology Multi Criteria Analysis

Figure 13 (4) Stakeholder engagement and DD techniques across a VC life cycle.

DD techniques are helpful in enabling and facilitating the participatory sustainability approach. The rationale behind the recommended technique in each stage is more based on the set engagement objective. In the first stage the likely engagement strategy is more on consultations, dialogue and validation of the set project goals. World cafés and consensus forums are the most suitable techniques to facilitate such deliberations. The following stages 2 and 3, require more deliberation, active participation and ideation based engagement interests. Accordingly, the selected DD techniques, such as the 21st Century Dialogue, Open Space Technology and Multi-Criteria Analysis will help in identifying the issues, prioritization, and in achieving more committed participation of the stakeholders. Similarly the local area forum-based engagement will bring more of the micro level issues into focus and also solutions to solve any problems. These suggested DD techniques have been proven and will help to facilitate either larger or smaller group deliberations toward achieving a common ground. In addition to the above-suggested list of DD techniques, there is a host of stakeholder engagement techniques, tools, and campaigns, that are available with extensive literature and internet-based data sources. Stakeholder engagement objectives and the deliberation group size are key considerations in choosing an appropriate technique.

4.4. Step 4: Monitor Engagement Performance

Step four involves reviewing the stakeholder engagement model undertaken, and occurs after the process has started and is ongoing over the project's life cycle. A periodic review of stakeholder engagement is undertaken, at each stage of the VC life cycle. This helps in understanding the performance of the various stakeholder groups against the set objectives and targets. From time to time it is advisable to have a check point to measure the effectiveness of the engagement performance, and also to evaluate any risk groups or dependent activities. Performance indicators are a set of interpretable, communicable, comparable measures for tracking the engagement effectiveness at any defined engagement level or process. This is, however, project specific. Therefore, at the beginning of the VC process, check points, or stages to measure the performance, need to be identified.

The PSVC framework enables participatory monitoring and evaluation by internally defined indicators that are locally relevant, context specific, or stakeholder processes based on qualitative and quantitative judgment. Quantitative indicators are used to measure the magnitude of the outcome, while qualitative indicators describe the quality of the participation. At the same time, indicators may differ with respect to the aspirations of different stakeholder groups. Therefore, to accommodate such pluralism, a disaggregated model of indicators needs to be developed.

Furthermore, the level of engagement and the various stages of the VC life cycle in which engagement is desired would also influence the type of indicator to be applied. Primarily indicators are methods to analyse, monitor, learn, identify risks, and, if required, make course correction changes toward achieving the set engagement objectives. The World Bank-developed participatory monitoring and evaluation (PM&E) process tool proposes that indicators selected for a particular project need to be valid, relevant, specific, timely, reliable, sensitive, and cost-effective [39].

A suggested list of possible indicators for process participation across the VC life cycle within a PSVC framework is summarized in Figure 5. The suggested indicators list is by no means meant as a model list of indicators to be used, but rather as a guide, as an example of what might be needed in various project practices. Various tools, such as before and after surveys, stakeholder feedback forms or interviews, questionnaire-based responses, opinion surveys, web-enabled feedback inputs, measurable outcomes or commitments, are applied to gather data for the indicators.

VC Life Cycle Stages	Performance Indicators
1 Initiation: VC concept	<ul style="list-style-type: none"> • Over 80% participants endorsed the project need • Broad based stakeholder groups identified • Opportunities and Constraints for VC identified • Active deliberations resulted
2 Planning: VC planning	<ul style="list-style-type: none"> • Over 70% participants support VC idea for funding • Funding and other priorities listed • Transit catchment area defined • Transit plus station neighborhood issues and value documented
3 Design: VC Design	<ul style="list-style-type: none"> • Combo of VC mechanisms identified with over 70% of stakeholder endorsement • Improved deliberation quality • Over 70% participants agreed to VC tools identified • Community groups on boarded into VC steering group
4 Strategize: VC strategies	<ul style="list-style-type: none"> • Identified VC collection methods • VC fund created • VC fund redistribution finalized • Over 70% of stakeholders satisfied on fund redistribution strategies • Community have a say in VC fund spent created
5 Execute: VC Implementation	<ul style="list-style-type: none"> • Public website on fund spent • Public audit report on VC fund • Shared responsibilities • VC fund created
6 Operation: VC Governance	<ul style="list-style-type: none"> • Community members on VC fund board • Influence zone development plan • Regular audit and real-time access to progress, and fund • Transit VC Inclusive governance model established • Regular feedback with over 75% satisfied with VC progress and operations

Figure 14 (5) Stakeholder engagement monitoring and indicators across a VC life cycle.

The next section of this paper describes how these PSVC framework steps could be applied in practice, utilizing a case study of the proposed Bangalore suburban rail project.

5. PSVC Framework Applied to the Proposed Bangalore Suburban Rail Project

Bangalore city is urbanizing at an unprecedented scale and has a current population of over 8.5 million. The urbanization process has been defined by increasing urban sprawl (though not as low density as in American cities) and the development of a complex transport pattern (increasingly car dependent). This urbanization process presents a formidable commuting challenge today. The Comprehensive Traffic and Transportation Plan for Bangalore recommended the implementation of a suburban rail system, to link Bangalore to surrounding cities within a radius of 50–70 km in order to help reduce dependence on road-based transportation [25]. Considering the potential benefits of suburban rail services, the State Government of Karnataka has given its in-principle approval for the project, and a Detailed Project Report (DPR) for its implementation has commenced [40]. Currently, the proposed suburban rail plan is to use the existing inter-state rail network of about 370 km to connect towns, suburbs, and the inner city by introducing capacity and improving the frequency of operations.

Along with the DPR preparations, the Government of Karnataka is also keen to explore alternative innovative financing options to build the suburban rail. To this end, the Directorate of Urban Land Transport (DULT) from the Government of Karnataka State, India, signed a memorandum of understanding with the Curtin University Sustainability Policy (CUSP) Institute, Australia, and Center for infrastructure, sustainable transport and urban planning (CiSTUP) of Indian Institute of Science, Bangalore to help facilitate a VC-based funding strategy. According to the VC life cycle described above, the current progress of this suburban rail project can be defined as between the “Initiation” and “Planning” stages. Though, conceptually, the project initiation and feasibility study was completed in 2013, the participatory route through stakeholder engagement has not been initiated thus far.

Therefore, as part of this project, under the auspices of AusAID sponsorship, a two-day stakeholder deliberation workshop on “Bangalore Suburban Rail Project: potentials for innovative financing and planning strategies” was held on 9–10 October 2013, in Bangalore, India. The objective of this workshop was to introduce VC- based innovative financing mechanisms through knowledge-sharing sessions and to conduct deliberation on the feasibility of the application of such VC concepts in the Bangalore suburban rail project context. The workshop used a participatory sustainability approach to which the PSVC framework was applied in order to demonstrate its use in practice, particularly the applicability of undertaking stakeholder

engagement, using appropriate DD techniques. The core question for the deliberation around using VC in the Bangalore Suburban Rail project was identified to be “can we improve understanding and skills around transit oriented design and VC based suburban rail financing through stakeholder engagement using deliberative democracy techniques in Bangalore?” This project has enabled the testing of the application of the PSVC framework. The steps undertaken during this process are described next following the four-step PSVC framework described above, along with detailing the process so far, the outcomes and the way forward for this innovative project.

5.1. Step 1: Stakeholder Identification

Following the PSVC framework classification, as the first step we identified the stakeholders that would be involved in this project. They were broadly identified as: state government agencies, railway organizations, and representing the “investor” group; the local station residents and business groups, including slum dweller representative associations residing within a distance of 1 km from station, and community groups from suburban towns representing the potential “wind-fall beneficiary” groups; and, finally, the community group stakeholders identified as representatives from citizen forums, NGOs, and resident associations. On the first day of the workshop deliberation involved about 80 high-level participants from a wide range of organizations and also community members. The second day involved a smaller group of 26 key stakeholders, to summarize and agree on the next steps. These Day 2 participants were selected in such a way so as to ensure at least one or two representatives from the all identified stakeholder groups participated in the “way forward” discussion. Primarily, Day 1, with greater participation, planned for deliberation, and Day 2 planned to summarize the deliberation into action and agree on a way forward.

5.2. Step 2: Set Engagement Objectives

Following the PSVC framework, the project was defined as “post initiation” and in the “planning” stages of the VC life cycle. This provided an opportunity to orchestrate the stakeholder engagement workshop during the second stage “planning” of the Bangalore suburban rail project. This workshop primarily focused on bringing together key stakeholders of the proposed Bangalore suburban rail to deliberate on innovative financing options using VC mechanisms and to determine a way forward that maximizes suburban rail attractiveness, sustainability, viability, and accessibility. The stakeholder engagement objectives defined were to encourage deliberation on

the identified core questions and understand stakeholder willingness to participate in the VC-based financing process.

Keeping in mind that no prior stakeholder consultations had taken place during the project initiation stage, except for a consultant study on project feasibility, it was decided to include a knowledge-sharing session during the workshop on Day 1. This provided an opportunity to enable all stakeholders to understand land-based VC financing mechanisms and to hear from experts sharing global best practices. This was followed by a core group deliberation, which included validating the VC concept with respect to its applicability to the proposed Bangalore suburban rail project. The key sub-questions discussed during the focused deliberations were: “how can we make VC work in Bangalore?” and “which one among them will be the most important to make VC work in Bangalore?” The deliberations concluded with a discussion about the constraints and opportunities of the VC process in the Bangalore context.

In the future, if the process was to follow the PSVC framework, a number of deliberation workshops would need to be organized as per the suggested stakeholder interventions across the VC life cycle stages, as presented in Figure 2. These could include stakeholder participation across remaining stages of the life cycle: the “VC design”, *i.e.*, to identify the appropriate VC instruments to value assessment, stakeholder willingness to participate, as would be appropriate in the project context. A project steering group with representation from the stakeholder community could help in creating the ‘roadmap’ to strategizing the VC process. This would enable stakeholder involvement to move from participation to engagement. The following fourth stage, “VC strategies” would set an agenda for the stakeholder community to jointly structure the VC fund and its redistribution strategies, as identified upfront. Then, in the fifth stage, “VC Implementation”, and the last stage, “VC Operationalization”, it enables stakeholders to be part of VC governance through reviewing the progress of the project and evaluation of the VC process, as measured by the stated engagement interests and commitments.

5.3. Step 3: Select Engagement Techniques

This stage is about identifying the appropriate stakeholder engagement techniques, as recommended by PSVC framework, appropriate for the “planning stage” of the VC life cycle. On Day 1, the two main DD techniques deployed were: 21st Century Town Meeting/Dialogue and Multi Criteria Analysis (MCA). On Day 2, the DD technique used was the Open Space Technology technique [25]. Day 1 involved small, facilitated groups, using networked computers linked to an innovative online software platform. This platform is designed to facilitate the finding of common ground and common priorities. For key sub-questions, the responses received were classified in

real-time into major themes, with the aid of on-line software, and then themes were reviewed and prioritized by participants with an appropriate score assigned to each using weightages. These themes were ranked using the MCA technique. The participants also deliberated on constraints and opportunities around adopting VC in the context of the proposed Bangalore suburban rail project.

At the end of the Day 1 deliberations, a “Workshop Outcome Report” detailing the key points from the day, including expert presentations and a complete copy of workshop deliberations, key themes, and prioritization scores was compiled and distributed to each participant. Participants were very excited to receive their report, as shown in Figure 6. This presentation of the report was very important to maintain interest and enthusiasm with participants, as it enabled participants to have key outcomes immediately, rather than waiting for a report to be produced a few weeks later, as typically happens in traditional workshops [29]. The workshop on Day 2 used the Open Space Technology technique. On Day 2 about 26 key participants representing all stakeholder groups deliberated on the key outcomes from the previous day, and then identified actions, task-owners, and milestones moving forward.



Figure 15 (6) Participants showing the receipt of workshop report in real-time

5.4. Step 4: Monitor Engagement Performance

At the end of the event, the workshop results and processes were analyzed and the engagement model used was found to be very positive. This is the first stakeholder workshop in the proposed sub-urban rail project context. As stated earlier, project progress could be defined between the initiation and planning phases. We apply the PSVC framework then the current VC processes are defined between the first and second stages of the VC life cycle. The results are, therefore, primarily evaluated based on the suggested indicators of the PSVC framework, stated in these two

stages. Firstly, the workshop was a success in identifying and involving broad based stakeholder groups, including the government, public, private, city community, sub-urban community, local governments, and resident associations from sub-urban station neighborhoods. Secondly, the workshop achieved a consensus on the significance of the sub-urban rail project, and endorsed the urgency of its implementation. The workshop also demonstrated the key learning of VC concepts shared, which were reflected in active stakeholder deliberations. Lastly, all stakeholder groups unanimously agreed that land-based VC financing was appropriate for the project, and also suggested barriers and opportunities in the current system, along with high-level solutions for the alternatives proposed, which was truly a great result within such a short time.

Overall, using the DD process uniquely transformed the role the public normally plays in traditional community consultation, from combative and divisive to cooperative and co-intelligent. As a result of the workshop, being the first of its kind, many more such stakeholder interactions will be planned to achieve the set engagement objectives [40]. This workshop could not yet identify the enablers or community champions to be sought out, which require other channels and one-on-one meetings to ensure a committed participation. In order to understand issues at the network level, many more station-neighborhood-based deliberations need to be organized to finalize the plans. Although the workshop discussed the sub-urban rail network influence zone to be within a 1 km radius from the metro rail, opinions may differ in the sub-urban areas. This again underscores the need to organize sub-urban-based micro-level deliberations at a later stage. Lack of transit funding and other sustainable transportation planning issues were deliberated in the workshop, but require more such deliberations to finalize the priorities list. The identified high priority issues, such as lack of coordination between multiple agencies involved, highlight the fact that transit and development are still functioning in silos and are large challenges for VC-based participatory transit governance.

As this was the first attempt to bring all stakeholders on to a single platform, the performance indicators were not developed on a collaborative basis. In the future, based on the current learning, such targets and expectations can be collaboratively decided in advance of such deliberations. The authors recommend that performance indicators should be classified into macro-level and micro-level targets to measure the outcomes, and identify the need to plan future deliberations or campaigns to achieve the set objectives. This evaluation, therefore, can conclude the event as a 100% achievement, as far as broader macro-level objectives of information sharing, project significance, willingness to participate in the VC process and its applicability, are concerned. In conclusion, this evaluation also recommends a series of such deliberations and campaigns in the future, during the project planning phase, to further identify stakeholder champions, station-level

or network level priorities, and to more clearly seek station community goals and unique sub-urban area concerns that impact on the value proposition.

5.5. Discussion

The deliberation process around the potential of VC in Bangalore enabled real discussions across a variety of stakeholders, enabled potential oppositions or tensions to be considered, and a variety of viewpoints to be expressed, debated, and then a common understanding to be developed. For example, stakeholders deliberated and discussed, in smaller groups, potential “constraints and opportunities” to utilizing the VC process in the Bangalore suburban rail project. The group responses were classified in real-time, with the aid of on-line software, into major themes coming from the entire group. These themes were then prioritized. This technique facilitate iteration, enabling the group to continue discussing until a clear idea or action was identified. Indeed, using the MCA technique with weightings to prioritize the themes, helped to define the whole VC process. From the example above, “constraints and opportunities”, the major constraint to utilizing VC in the Bangalore suburban rail project was collectively decided to be that: “There is a lack of collaboration, coordination and capacity between and within agencies, with many conflicting interests. Better coordination is essential”, and for opportunities, “VC schemes are popular and offer opportunities for involvement with various stakeholders (private sector, developers, land owners and citizens)” [40]. From this, the next steps can be determined and potential opposition can be aired and deliberated on so that a common understanding is developed and formalized through the workshop outcomes report. In this example, this was undertaken very quickly, in two days, using the framework driven approach described above. Overall stakeholder acceptance of the VC process and the feasibility of the project was agreed on. If the participatory sustainability approach had not been undertaken, then developing this common understanding may have taken a much longer time, using more common stakeholder engagement processes, or not happened at all.

Moreover, the PSVC framework-driven stakeholder engagement approach, not only provided a platform for facilitating the development of a common ground, but also provided a source for cross-pollination of new knowledge and new ideas to VC value assessment. For example, when the beneficiary group deliberated in smaller groups, they deliberated on what the possible equity implications were and also the possible negativities they would face during the project construction phase. In reality, this group, due to their proximity to the project site, does experience much greater anxiety, interruptions to their businesses, traffic chaos, and other pollution-related negatives during the project construction period. Thus, the discussion occurred regarding how this negative

externality could be compensated for from the increased land value gained later in the process, how this could be designed into the appropriate VC mechanism, and how this could be used to determine the value assessment criteria in VC design at a later stage. These ideas and discussions may never have occurred without this deliberation.

Additionally, the group deliberated on commuter demand from the affordability criteria rather than proximity-based traditional capacity estimates, which may often lead to exaggerated demand. This is an important input for suburban rail capacity planning as the beneficiary community mainly provides the catchment capacity and also source for fare box revenues at a later stage. Lastly, participants identified support infrastructure requirements, such as bicycle paths, foot paths, auto-rickshaw parking, vehicle parking and smart fare systems, as essential investments and critical to making the station accessible and suburban rail an attractive commuter choice. This enhanced the scope of VC financing, to not only cover the cost of the rail infrastructure provision, but also to include the cost of providing the support infrastructures around the stations as well. Often, these support infrastructure investments are ignored during VC redistribution by rail authorities, as most of such support infrastructures need to be provided by other government agencies.

The above are a few examples that highlight the significant value of the deployment of the PSVC framework-driven participatory sustainability approach to positively contribute in enhancing the planning and design of the VC process. The received inputs from the stakeholders were very useful for this planning stage, and will greatly help the Bangalore suburban rail VC design stage. As part of the next steps, post-DPR study completion, it was agreed to initiate the value assessment along the identified suburban rail corridors to identify potential VC mechanisms and strategies to generate revenues.

Overall, participants found several meaningful opportunities to engage in public deliberation, policy development, and decision-making during the workshop. Though it was a successful deliberation within the given constraints of time, stakeholder participation has not yet translated into engagement levels. As the project is still in a planning stage, as a work-in-progress, further stakeholder engagement needs to be continued throughout the life cycle of the VC process. Another important immediate future step is to identify key stakeholders to be a project steering group. Thus, the PSVC framework, applied to the proposed Bangalore suburban rail project in India, has demonstrated the importance of stakeholder engagement in order to enable sustainable development community goals and to review VC strategies from a win-win perspective.

6. Conclusions

VC integrates the land use and transit system to enable an alternate revenue source, which is traditionally ignored due to a flawed revenue focus. However, using VC as a pure revenue raiser, instead of incorporating a participatory approach, is likely to lead to inequitable results. A participatory approach is, thus, an essential element of all VC planning and implementation processes. Stakeholder participation enables concerned parties to understand each other's requirements and limitations, and allows them to work together to reach solutions in a consensus. To this end, the PSVC framework described in this paper provides a unique attempt to enable stakeholder participation in the VC process, and also enable stakeholder participation to strengthen the outcomes of the VC process. The PSVC framework utilizes deliberative democracy stakeholder engagement techniques. These enable each person to meaningfully participate. The PSVC framework is described and tested in the Bangalore Suburban Rail case study. The framework has the potential to provide an important step forward in mobilizing stakeholder support to the innovative financing option of VC, as well as potentially enabling the VC process to explore its true potential. The results suggest that the PSVC framework provides a powerful tool to visualize the value of the project from the point of view of all stakeholders, and also enables increased acceptance and understanding of the project. The PSVC framework also enables the minimization of risks through the early involvement of the stakeholder groups (investors, beneficiaries, and the community). Furthermore, the PSVC framework has the potential to be applied to stakeholder engagement in any VC-based transit-financing project globally, and could be extended to other forms of VC-based urban infrastructure investment by modifying the objectives and the stakeholder groups to reflect the context of the project.

In conclusion, stakeholder-driven VC approaches can shape and reshape any transit-oriented development in compliance with sustainable development goals, including community aspirations with well-defined value creation and value redistribution strategies upfront.

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Author Contributions

Satya Sai Kumar Jillella contributed to writing and completion of manuscript, established the research paper design, paper methodology, policy analysis, and preparation of tables and figures. Annie Matan supervised, and assisted with the manuscript compilation, editing, and co-authorship of manuscript. Peter Newman supervised, and guided with editing and co-authorship of manuscript. All authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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Manuscript 2: A Value Capture Driven Rail Co-Creation Framework to Unlock Public-Private Partnership for Urban Rail in Emerging Cities

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Article

A Value Capture Driven Rail Co-Creation Framework to Unlock Public-Private Partnership for Urban Rail in Emerging Cities

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Abstract:

Many cities in the 21st century are planning for urban rail projects. Indian cities with over 1 million population are planning to build urban rail but face funding challenges. Recently the Government of India has enacted a new metro rail policy mandating private investments to build urban rail. Worldwide, land development led urban rail projects are being used to attract private investments in urban rail. In India, such experience is limited and subdued as a few private-led rail ventures failed, however they did not use land development mechanisms. How to make urban rail attractive to private investors remains a challenge. This paper aims to review piloted private rail projects and selected global best practices to understand the key issues and lessons. Further, it proposes a Rail Co-Creation Framework to shape land development based private partnerships, with an entrepreneur approach, to build the urban rail with application to all emerging cities.

Keywords: urban rail; Indian cities; rail co-creation framework, PPP, transit financing; metro rail policy; private investments.

Highlights:

1. The new urban rail in India is required to have public-private partnerships (PPP) by the new Metro Rail Policy (2017).
2. Non-fare box revenues and property development are emerging as a promising source to fund the urban rail.
3. The study confirms that no two PPP models are alike and no one size PPP solution suits all. However urban rail PPP's will need to enable land development to be viable.
4. The RCF orchestrates a win-win-win collaboration model to co-create the urban rail with the land development driven private investments and community engagement ensuring high value outcomes.

1. Introduction:

Many cities are planning for rail transit-driven mobility to help catalyze sustainable development opportunities (Jillella and Newman, 2016). Many car-dependent cities in the US, Europe, Canada, and even oil-rich Middle East have turned to rail (El-Geneidy, 2013). Over a hundred Chinese and Indian cities are building urban rail to cater for their significant travel demand (Newman, 2014). Currently India has 379km of metro rail lines in operation, and 512km is under construction (Metrorail news, 2017). Many cities are now drawing huge expansion plans to multiply the positive impact of their urban rail networks. Urban rail initiatives in Indian towns with over a million plus population are approved politically, which means another 40 plus new rail proposals. All these are facing significant funding challenges. Funding shortfalls are resulting in delays, deferment or simply smaller increments of the planned urban rail network in Indian cities (Jillella et al. 2016).

Presently many urban rail projects are based on the Delhi Metro joint venture (JV) model with debt/equity ratios of 1.5:1 having state and central governments equity shares and about 60% raised through debt financing from donor agencies like Japanese International Cooperation Agency (JICA) in case of Delhi Metro (DMRC, 2017). Seven out of 10 operational metro lines followed this model (NewsClick, 2017). This government guaranteed funding model is now shrinking due to competing demands, and it is grossly insufficient to fund the planned urban rail expansion. This model underscores the need for a paradigm shift from the traditional budgetary funding dependence to innovative financing options to construct the urban rail ((Jillella and Newman, 2016). This paper therefore addresses the following questions: Can private equity participation and value capture (VC) mechanisms help fund new urban rail? If so what kind of partnership framework can enable this to be implemented?

Worldwide many cities have successfully tried out land development based public-private partnership (PPP) models to help meet the financing gap for capital-intensive urban infrastructure. To this end, the Government of India on 16th August 2017 approved a new metro rail policy mandating that private investments are necessary to build the planned new urban rail. With the new strategic impetus for PPP, the country has now entered a potential growth phase in urban rail building. However, unlike other sectors like highways with toll revenue attractions, private player's appetite toward capital-intensive urban rail systems is said to be low due to higher risks and low

returns. PPP in urban rail is not new in India, but is less explored and is still a largely untapped story in railroads (Indian Express, 2017; ICRA, 2017).

Presently there are six urban rail-based PPP project initiatives in India. Among them, Mumbai Metro Phase 2 PPP project was dropped before the start of the project while the Delhi Airport Express Line PPP project terminated after it became operational. Operational metro rail PPP projects include Mumbai Metro Phase 1 and Rapid Metro in Gurgaon with two phases, but are incurring huge losses with low fare box revenues. Lastly, the Hyderabad metro project which is due for operations soon has faced implementation issues and delays. As a result, private investor's interest to take up PPP projects in India is subdued (Metrorail news, 2017). Despite the new metro policy promoting PPP's in urban rail projects, the actual project structuring in all these pilot PPP urban rail models are very different from one another. The differentiated variety of each of the PPP engagements makes an interesting case to review seeking insight on what worked and what did not. This paper, therefore, proposes to consider these piloted PPP urban rail projects and a selection of global best practice PPP's in order to understand the key issues and lessons learned. This will then be used to create a new partnership framework that may appeal to cities and private investors to enable more urban rail programs to be implemented.

To this end, this paper proposes a Rail Co-Creation Framework (RCF) offering guidance to co-create such PPP based collaboration to build urban rail. The RCF aims to provide an effective PPP collaboration platform for multiple stakeholders coming together with a common goal of unlocking private partnerships to build the urban rail. RCF also leverages VC mechanisms to sustain the PPP model as a new practice and enables community engagement. Thus, the lessons learned and the proposed RCF framework can be later applied and benefit other emerging cities as well.

2. Brief on Government of India's New Metro Policy, Aug 2017

The Government of India approved the new metro rail policy on 16th August 2017 mandating states to include private players among others in the provision of metro rail services (Indian Express, 2017). Further, it is compulsory to include last mile connectivity and value capture

financing options as part of their metro rail proposal. The project proposals now require EIRR⁸ of 14% compared to earlier practice which required FIRR⁹ of 8% for approvals.

The new metro rail policy is compelling cities to do detailed analysis on project viability both from an economic viability perspective and to get private participation before submitting a proposal to central government financial assistance. Cities are now advised to submit their urban rail proposals seeking federal aid in any of the following three project model options:

Option 1: Public-Private Partnership (PPP) with central VGF assistance.

In this option, the central assistance will be in the form of viability gap funding (VGF). This option is a typical PPP model with VGF incentives. VGF will act as a seed capital to attract private funding. Hyderabad metro rail project is an example of this model.

Option 2: Grant by Centre as 10% lump sum amount of total metro rail project cost.

The rest of the capital is to be raised based on state and private sector commitments.

Option 3: JV model with centre and state debt/equity model

This option follows the current JV model in practice wherein the centre and the state government will invest equally to share the costs and the balance (if any) can be routed through private equity or donor agencies combinations.

Nonetheless, for all the three options the involvement of private players is mandatory. Only the scale and role of their participation may vary.

The other key aspect of the proposal is to include the last mile connectivity provision for a catchment area of 5km from the station. The last mile feeder services commitment from the government is to be provided via feeders, walkways, pathways and para transport means to ensure

⁸ EIRR - Economic Internal Rate of Return

⁹ FIRR - Financial Internal Rate of Return

better ridership.

The policy also mandates cities to explore and analyze other public transport options from a cost and efficiency standpoint so it is not just heavy urban rail (metro). Such analysis will help avoid mass copying or superimposing the expensive Delhi metro rail model across all cities irrespective of their size, need and capacity.

Overall, the new metro policy impetus on land development based PPP models is a step toward viable financing options to enable urban rail. The core challenge today for many cities is how to attract, execute and sustain such private funding to build the urban rail. Land development based private sector partnership offers a potentially feasible approach for financing urban rail (Newman et al., 2017).

3. Review of PPP based Urban Rail Project Experiences in India

The review of six current PPP based urban rail projects shows to begin with that there is no dearth of private investors in India. However as is shown below there is a need for a viable win-win approach to build on these first experiments. Currently, Reliance Infrastructure Limited (RIL), the leading private infrastructure players in India, invested in three urban rail projects including Delhi Metro Airport Express Line (abandoned), Mumbai Metro Phase 2 (withdrawn) and Mumbai Metro phase 1 (in operation). Gurgaon's Rapid Metro rail (Phase 1 & Phase 2) is in successful operation with 100% funding by Infrastructure Lease & Financial Services (IL&FS) group, a global industry player (Sharma R et al., 2015). Lastly, the Hyderabad Metro, the world's largest PPP urban rail project is readying for operation and is funded by the Larsen and Toubro (L&T) led consortium, the top construction brand of India (Sridharan E., 2017).

3.1 Delhi Airport Express Rail – An O&M financing PPP model

The Delhi Airport Express Rail PPP project was an Operations and Maintenance (O&M) financing PPP model contract and the entire civil construction cost was undertaken by the Delhi Metro Rail Corporation (DMRC) representing government funding. The RIL group as a private partner was brought in with a 30-year O&M contract concession period to own-operate-maintain and transfer (OOMT). RIL started operations in 2011 but by 2013 it abandoned the project and terminated the Concession Agreement citing the defects in the civil structure, which was designed and built by

the public sector (DMRC). Later as per a court order, DMRC paid a huge penalty of US\$18.4million (INR 2,950 crores)to RIL to abandon the agreement (Joanna, 2012) and took over the operations also.

Questions have been raised about the level of partnership generated in this project. Both blamed each other for the fiasco. One version says DMRC was not in favor of privatization so never committed to partnership success. The other version from RIL reported that during the first few months of operation the company incurred huge losses and found the project was financially not viable due to low patronage. The projected daily ridership was 40,000 commuters per day but the actual ridership never crossed 20,000 commuters per day. Even when DMRC took over the operations, the ridership was less than 11,000 commuters per day (Sudhir P.S., 2013). The inflated projections possibly skewed the financial viability for the operator, although citing low-quality construction issues, the RIL was bailed out from the venture with some costs recovered from the penalty paid. The report concluded by stating that DMRC and RIL had major lack of integration issues and functioned in silos as two different entities than as partners.

Comments:

The key issues appear to be low ridership level, low construction quality, and lack of trust in the public private partnership.

3.2 Mumbai Metro Rail

Mumbai Metro is India's first PPP metro project in which all the three phases of construction, operation, and maintenance were executed by the private sector. A 35-year long concession agreement on a BOOT¹⁰ basis was awarded by the government agency (MMRDA¹¹) to the concessionaires (Pravin Singh, One India 2014; Sharma R et al., 2015). A special purpose vehicle (SPV), Mumbai Metro One Private Limited (MMOPL), was formed to implement the project. The

¹⁰ BOOT: Built-Own-Operate and Transfer

¹¹Mumbai Metropolitan Region Development Authority

SPV included the concessionaires (RIL and Veolia Transport) and MMRDA, with equity stakes of 74% and 26% shared respectively.

This project is one of the first projects in mass transportation systems executed on a PPP basis in the state thus it is likely the government wanted to monitor the project closely. The state government kept a 26 percent stake in the SPV and nominated three officers on its board (Pravin, 2014).

The project cost escalated by 84% due to delays and rising costs. Reliance Infrastructure-led MMOPL failed to complete the project before deadlines due to many factors such as changes in designs, currency depreciation, utility shifting, slow approvals from the state, and delay in receiving permission from Indian Railways (Sreedharan E, 2017). There was a dispute over the level of the fares needed to cover the costs of the project with MMRDA citing the rigid contract which had not agreed to share the burden of escalated costs.

MMOPL later approached the state government and the MMRDA to hike the ticket fares to accommodate their cost escalations. However, it was turned down due to political sensitivity over public opposition to higher fares. Such huge losses led to conflict between the concessionaire and the Government. Finally, the concessionaire dropped out from the unbuilt Phase 2 but continued operating the first phase.

Comments:

The over-reliance on fare-box revenue, administrative delays in getting approvals from a host of different agencies, rigidity of the contract agreement, partnership obligations and lack of win-win approaches are the major issues. Lack of adoption of VC financing strategies undervalues and underestimates the PPP potential in the world's biggest urban rail system.

3.3 Gurgaon - Rapid Metro (Case study source/ICRA report/PPT)

The Rapid Metro rail of Gurgaon city is the first Indian urban rail PPP wherein the private party fully funded (100%) the metro rail project. The PPP has a 99 year concession period under DBFOT (Design-Build-Finance-Operate and Transfer) with a 12km operational length as a Delhi Metro loop line (Sharma et al., 2016).

The concessionaires, Delhi Land & Finance (DLF) and Infrastructure Lease & Financial Services (IL&FS), formed an SPV titled Rapid Metrorail Gurgaon Limited (RMGL) to implement the project. DLF owns many properties near the rail stations and the project is primarily catering to a very concentrated area of DLF Cybercity real-estate of 15 million square feet linking with Delhi Metro. Initially, ILFS group has a 74% share whereas DLF has the remaining 26%. Later DLF sold its share to IL&FS (Sumit B, 2013).

As far as the revenue sharing model is concerned RMGL is entitled to receive all the fare box revenues, station advertising revenues, naming rights and station real-estate commercials. HUDA, the local government authority is not part of the SPV and is only responsible for providing them with the right of way and charge RMGL for connectivity charges at INR 40 crores per year from the 17th to 35th year for right of way. HUDA also receives 5% to 10% share on non-fare box revenues. The concessionaire has encountered cost escalations due to administrative sanctions and approval delays (Sumit B, 2013).

RMGL currently is showing revenue loss and the issue again here is low patronage and competition from cheaper alternate para-transit modes serving this corridor. RMGL Metro's average daily ridership has remained low during FY2016 and the first half of FY2017. It has been within a range between 25,000 – 27,500 daily ridership which is significantly lower than the break-even ridership levels and is also much below the projected patronage of 100,000 commuters per day (ICRA report, 2017).

Comments:

With 100% funding, this project became a solo private sector initiative and is not integrated with city development plans. The review noted that the PPP appeared to be inadequately structured and there was scope for improvement for a win-win approach. The public sector needs to own an active role, primarily ensuring the redevelopment opportunities that can help raise revenues for both the private and public partners. The PPP could then use VC financing options that would benefit both sides of the partnership. The losses are only temporary for the first few years considering there is a 99 year lease period which should bring in development around stations but the fact that it was not included from the start is a mistake. Revenue guarantees for the first few years could have helped sustain the operator's cash flows but land developments would have been a much more

certain revenue flow.

3.4 Hyderabad Metro Rail

Hyderabad Metro runs across 72 kilometers of the city with 66 stations and three depots. This large project is another unique PPP initiative with a rail plus property development revenue model. The Hyderabad Metro Rail PPP model was structured with 91% from the private sector and 9% by the Govt. of India as VGF; the state government is bearing the cost of land acquisition and utility shifting. The CA on a DBFOT basis is for 35 years (Suzuki H et al. 2015).

3.4.1 Governance model:

To coordinate and manage the project, the state government set up a Hyderabad Metro Rail Limited (HMRL) as an SPV. HMRL incorporated was established to function as project coordination, monitoring, and a concessionary authority. State government appointed a Managing Director to provide dedicated project leadership and staff from across agencies on deputation and directly hired specialized skills or expert resources. The HMRL board members comprise the State Chief Secretary, the Commissioner of the Greater Hyderabad Municipal Corporation (GHMC – Hyderabad urban local body) and the Managing Director of HMRL.

3.4.2 Procurement

Hyderabad Metro also experienced early road blocks. This project encountered major unexpected financial difficulties during the first procurement stage after the first bid closure. After a rigorous procurement process of 3 years, the selected bidder failed to make financial closure due to their internal organizational problems. This development led to re-tendering based on a new RFQ and RFP process with financial bids. Based on the lower VGF bidder criteria, the L&T consortium won the contract in 2010. Within six months L&T had successfully deposited performance security and achieved the financial closure.

3.4.3 Public financing

The Government of India (GoI) has a minority stake in the project, contributing 9% of the total project cost as viability gap funding as negotiated in the lowest bid from L&T.

Also, the state government contributed about USD 0.32 bn (INR 1,980 crore) towards land acquisition and in the end the last mile connectivity was managed by Hyderabad Metro Rail which focused on inter-modal integration, Non-Motorized Transport (NMT) facilities, a good feeder bus service and pedestrian facilities.

3.4.4 Private financing

The project is estimated to cost USD 2.8 billion (INR 14,132 crore). The balance, 91% of the costs (about INR 12,674 Crore) was funded by the concessionaire (L&T). To this end, L&T set-up an SPV "L&T Metro Rail (Hyderabad) Limited (LTMRHL)" to implement the project and raise the funding and finance. L&T procured their investments through 20% equity and 70% as debt finance. A consortium of ten banks sanctioned the entire 70% debt (INR 9,906 Crore) requirement of the project and the 20% equity (INR 2,768 Crore) component for the project was funded directly by the L&T with its funds. Also, about USD 0.36 bn (INR 2,243 Crore) toward the Phase 1 property development was allocated by L&T for lease rentals. LTMRHL has used international consultants for this major project and engaged renowned architects for property development. This LTMRHL SPV is also helping in establishing seamless coordination with the HMRL who also execute the project.

3.4.5 Revenue model:

The PPP revenue model was structured on a rail plus land/property development basis. The model is based on 50% of the revenues coming from passenger fares while 45% is through station property development and 5% from advertisements, and parking charges (i.e. 50% from land-based value). The concessionaire was allowed to commercially develop real estate in 18.50 million square feet areas at the depots and stations. The concessionaire was authorized to undertake real-estate development at and above the first-floor level of all depots and to have access to 20% of the floor area of each station for commercial development. Also, the concessionaire can undertake real estate development over the parking and circulation areas at the station. The concessionaire cannot sell the property so developed but can enjoy the lease rentals from property development during the concession period. Fare box revenues, station rentals, advertising, parking and carbon credits are the projected revenues of the project.

Comments:

Overall Hyderabad Metro is a good model. It has a good risk profile, has well-defined tariff structures, has well-documented price escalation formulas and penalties for both parties if the CA obligations not fulfilled. LTMHRL also received strong support from HMRL, the state administration and political leadership which helped in many ways to champion the cause of removing many administrative road blocks. However, HMRL has also been facing delays in land acquisition, land readjustments around stations, and also local community resistance and opposition to land use changes or high densification due to a lack of strategic community engagement. This PPP also impacted but survived the huge political turmoil due to the state bifurcation and creation of Telangana state with a sudden change in political leadership. This PPP has potential to be a role model for its structure and design subject to its performance during operations. LTMHRL jointly with HMRL needs to build on community stakeholder engagement to form further good will which will provide a sustained platform of support for the PPP into the future. This project is demonstrating high quality value capture mechanisms through something akin to the Entrepreneur Rail Model (Newman et al, 2016) as it has based 50% of its funding on land development and created TOD as well as a good urban rail project.

4. Global Best Practices: Transformation of Urban Rail PPP model

Phang (2009)(p 23) stated that around 1985 a privatization wave swept through the transport sector due to poor public-sector performance, fiscal crises and technological advances. The deregulation and privatization happened across several sub-sectors namely: airlines, roads, ports, airports, intercity rail, and bus services. However, the private sector appetite toward capital-intensive urban rail systems was found to be low due to higher risks, low returns, and other challenges. Japan and Hong Kong made an exception and turned around rail as a profit-making business model through integrating rail with land development. This innovative financing practice of land and property developments around transit stations and selling air rights to property developers above stations made a big difference to enable private funding into urban rail.

McIntosh et al., 2014 stated that both active and passive value capture could enable more significant private involvement in urban rail projects. If private financing is being used it is possible to involve private consortia in a PPP where not only do they bid to build, own and operate the rail system but they can also do entrepreneurial land development as part of their submission. In the case of private properties, many active VC mechanisms are available, for example:

development of private ownership or government land that has been specified to be part of the bid process; joint development of government land with industry; leasing the property for parking or development as fee-based revenues; rental returns on government property; and leasing the space for other income. Thus, a combination of active and passive value capture mechanisms could all be used to create a Transit Fund and hence create financing opportunities for the rail project. This will create collateral to attract private investments with some revenue guarantees as well. It is still fundamentally a government-led project however. Other more entrepreneurial approaches can be used to directly tap private investment.

Many cities, particularly in the US, Canada, Australia and South-east Asia, have successfully tapped private sector investments for new urban rail through land development. The Mass Transit Railway (MTR) Corporation in Hong Kong SAR, China, and the Japan Railway Construction Agency (JRCA), a public corporation of Japan Railway, are the best-proven examples of private led rail (Suzuki H et al., 2015). This paper considers the MTR experience as a basis for replicability in emerging cities such as India where only Hyderabad has so far managed to begin this journey of using land development to fund rail.

2.1 MTR, Hong Kong SAR, China

Rail plus property development is a core part of MTR Corporation's business model.

Governance model:

The MTR corporation is structured more like an entrepreneurial transit agency. The Corporation is overseen by a chief executive officer and an executive committee. They report to a Board headed by a non-executive chairman and made up of local business and community leaders and government representatives. MTR built institutional capacities by staffing experts in property development, town planning and other managerial skills. Peterson (2003, p.46) states that MTR originally was a public enterprise and in the year 2000, sold 23% of equity to private investors as a partially privatized company with 77% of their holding remaining with the government.

Financing and Revenue generation model:

The MTR corporation is a huge commercial success both in operational performance and financial

efficiency. Its revenue stream includes fare box revenues, commercial station retail rentals and through residential and commercial property developments around station areas. The MTR annual report confirms their success. Operations of the system are as close to perfect as any rail system in the system in the world with the FY 2015-2016 report stating that 99.9% is their on-time performance. The total revenues for FY 2015 were reported at HK\$ 41,701 Million. These revenues include 41% from transport operations, 13% from commercial development at stations, 11% from property rental and management services, 30% from Mainland China and international operations and about 5% of other support services and business. During the last ten years, MTRC revenues have grown over four times from HK\$ 9,541 Million in 2006 to HK\$ 41,701 Million in 2015 (MTR, 2016)

Increased Ridership through Property development:

The rail plus property model not only increased revenues but also helps develop densities with a creative and meticulous station area developmental planning approach. A review by Allport et al., (2008) found that an MTR station post property development added over 35,000-weekday passenger patronage to the transit system. Such significant outcomes demonstrate that transit station nodes are not just for land development but can contribute to increasing densities and thereby patronage to rail as well.

Comments:

Hong Kong's metro rail is a unique, self-sustained and profit-making business model. The success of the MTR Corporation is backed-up by a meticulous business strategy, strong governance, planning, policy and institutional support, and execution proficiency with an entrepreneurial orientation.

5. Lessons learned from the reviewed Urban rail PPP practices

This review has shown that no two PPP models are alike and no one size PPP solution suits all. The review confirms that Indian urban rail PPP's are so far successful in only one out of the four demonstrations and this has a long way to go to reach the high standard of the Hong Kong MTR.

The typical challenges include: low patronage, high investment and low returns; bureaucratic inertia; rigid contracts; flawed risk-sharing; fiscal uncertainties; poor accountability; distressing administrative delays; land acquisition hurdles; and skewed procurement processes.

The most significant lesson learned is that the combination of low patronage and low financial returns on urban rail can both be solved by land development based approaches to a PPP. Many urban rail agencies haven't used land development based VC tools that could have been used to enable urban rail to be built in partnership with a TOD. Many cities therefore lack integration of metro with urban growth plans and the secret is how to achieve this through partnerships with private investment in land development.

Lessons learned about PPP's for Urban Rail:

1. A PPP for urban rail is unlikely to work unless it is based firmly around land development as well as traditional revenue sources.
2. The key pre-requisites for a PPP model are: firstly, government commitment to PPP agenda, secondly putting the regulatory and legal framework in place, thirdly a well-prepared PPP model with win-win collaboration focus.
3. The key influencing factors for the successful PPP execution include strong governance, commitment, risk sharing, corporate orientation, negotiation, a transparent arbitration process, stakeholder participation, accountability, and visionary leadership.
4. Over the years, various forms of PPP engagement models evolved as given in Table 1. These can all be applied to urban rail however the model suggested to create the most value for urban rail is DBFOOT as outlined in the paper below.

Table 17 (1): Popularly practiced PPP models

PPP Model	Assigned Rights
BOT	Build-Operate-Transfer
BOLT	Build-Operate-Lease-Transfer
BOOF	Build –Own-Operate-Finance
BLT	Build-Lease-Transfer

BOOM	Build –Own-Operate-Maintain
BOOTT	Build –Own-Operate-Train-Transfer
BTO	Build –Transfer-Operate
DBFOT	Design-Build-Finance-Operate-Transfer
DBFOOT	Design-Build-Finance-Own-Operate-Transfer
ROFOT	Rehabilitate-Own-Finance-Operate-Transfer

5. Value for money (VFM) assessment incorporating private sector participation must show the additional value they will bring to the public and the community or some combination thereof to justify partnership.
6. Non-fare box revenues, especially property development around station areas, have proven to be the most promising source of new income but will need to be drawn in at the start of any PPP process, not after the project has been planned or built.
7. The review underscores the need for a contribution from the public sector in the form of VGF is very important to any partnership. The public outcomes desired from an urban rail and TOD project mean that government risk management should enable such investment to be facilitated. Other public involvement in land assembly and local approvals are also important.
8. The review underscored the need for a participatory approach to a PPP model which goes beyond the public and private sectors by engaging the active local community, civic society, academia and tax payers who will help remove obstacles and provide goodwill support with predictable execution. This suggests that PPP's should perhaps be called PPPP's – public, private, people partnerships. These can enable win-win-win outcomes.

Establishing and delivering a winning PPP collaboration poses the real challenge. This paper, therefore, proposes an innovative project-level execution framework called a Rail Co-Creation Framework (RCF) to shape the private sector partnership and build urban rail with TOD's. RCF is conceived on the principles of Co-Creation.

6. Preamble to Co-creation Strategy and RCF Core Principals

Co-creation is primarily a management or economic strategy, that brings different parties together to produce a mutually valued outcome jointly. The key new element for most transport agencies is how to bring private sector interests and investment into projects at an early stage.

RCF strategy inputs to attract private sector investment:

1. The best value RCF PPP proposition is design-build-finance-own-operate-transfer (DBFOOT) with long term lease contracts and VGF federal grants. This is the model which best follows the Hong Kong and Hyderabad case studies and is elaborated in Newman et al (2016).
2. The most significant part of the CA will be based around a TOD Plan for private investment in land redevelopment through a clear and viable set of development opportunities (TOD's) that are worked out in partnership with public and private interests being brought together.
3. An RCF will need an SPV to include a minimum guarantee transit ridership quantity as part of the CA for the first five years and pay from a VC fund in case of short falls. Such a revenue guarantee with demand assurance is likely to attract private investments as long as a clear urban development strategy underlies it.
4. The RCF business case can include station commercials, advertisement revenues as non-fare box revenues with about a 10% share paid back to the SPV operational fund.
5. Each network is identified with rail nodal centers as outlined in the TOD Plan, and a special density bonus (or in India the FAR for Band 1 to 3) which would apply for up to 500m around the station as another attraction to private investors. This would help increase patronage and is also possible to have a developer levy for VC.
6. The business case can recommend taxes or import duties or customs duties exemption during construction and lower or nil taxes for the first five years or break-even period whichever is earlier to act as another trigger to attract private investors.

Based on these principles and strategies, the Rail Co-Creation Framework (RCF) is structured and detailed in the following section.

7. A Rail Co-Creation Framework (RCF) to deliver PPP urban rail

The RCF provides a structured approach across the six stages of the PPP project life cycle from initiation to transitions as detailed below.

Stage 1: PPP initiation

Stage 2: PPP project planning

Stage 3: PPP procurement model (3P)

Stage 4: PPPP implementation (4P)

Stage 5: PPP operations

Stage 6: Transition and Transfer

The first two steps are public-sector dependent to formulate the project with an SPV governance model in place. However, it must add the important new element of evaluating the most important redevelopment outcomes as part of a TOD Plan. This will require market testing of land redevelopment potential and early community engagement to help shape the TODs and how they will relate to the rail transit system. The procurement model is the crucial stage of the PPP project life cycle and again it must incorporate some new elements including a new mechanism to ensure there is a partnership emerging on what are the main urban rail and land integration outcomes that are being sought in the tendering process. The fourth stage is where the PPP moves into being a true PPPP with significant community engagement to ensure the project is fully achieving value for the long term in both the urban rail and the urban development proposed. The fifth stage is focused on delivery with contract administration, management, monitoring operations and performance evaluation including an assessment of how well the land development process is proceeding. The last stage is in the context of transfer to the public sector. This stage 6 again requires a good transition, asset transfers, resource and knowledge transference to achieve a smooth transition. The macro-level perspective of the key elements of RCF driven PPP across the project life cycle are given in Table 2.

Table 18 (2): RCF PPPP Key Elements across Project Life Cycle

Stage	Action	Key elements	Task Owner
1.Initiation	<ul style="list-style-type: none"> • Feasibility & DPR • Type of rail transit and demand • TOD Plan (from public perspective) 	<ul style="list-style-type: none"> ▪ Validation of need and viability ▪ Alignment Design ▪ Evaluation of most important redevelopment outcomes ▪ Implementation & VC approach 	Public sector with some market testing of land redevelopment potential and early community processes.
2.Procurement	<ul style="list-style-type: none"> • Tendering Process and Transparency 	<ul style="list-style-type: none"> ▪ Bid marketing & response ▪ Scrutiny & Selection criteria ▪ Workshopping of urban land and rail integration needs 	Public sector Private Bidders
3.Partnership Agreement	<ul style="list-style-type: none"> • Concession Agreement 	<ul style="list-style-type: none"> ▪ Milestones ▪ Governance ▪ Risk-sharing ▪ Dispute resolution ▪ Termination 	PPP Stakeholders
4.Implementation	<ul style="list-style-type: none"> • Pre-metro preparations • TOD Plan approvals • Project schedules • Construction • Technical spec. • Quality & Safety • Cost savings • Innovation • Mitigation plans for traffic and pollution 	<ul style="list-style-type: none"> ▪ Approvals for rail and TOD's ▪ Schedules ▪ Construction progress ▪ Launch of integrated construction and land development ▪ Cost controls ▪ Innovation in transport and land development (SDG's) ▪ Last mile connectivity ▪ Station neighborhood amenity ▪ Passive/active VC mechanisms 	PPPP Stakeholders including community
5.Operations & Maintenance	<ul style="list-style-type: none"> • Fare boxes • Operational systems • Revenues (Fares/VCF/Advt./Rent/L and Sales) • Non-Fare box • Quality & Safety 	<ul style="list-style-type: none"> ▪ Ridership ▪ Level of service ▪ Value for money ▪ Impact assessment ▪ Security & Crime prevention ▪ TOD Plan evaluation ▪ Passive/active VC mechanisms 	PPP Stakeholders
6.Transfer	<ul style="list-style-type: none"> • Extensions (if any) • Handover terms • Assets and Process • Transition • Training • Audit 	<ul style="list-style-type: none"> ▪ Knowledge transfer ▪ Technology transfer ▪ Resource transfer ▪ Asset condition & transfer ▪ Quality assessment ▪ Audit Certification 	PPP Stakeholders to Public Stakeholder

8. Conclusion

Most emerging cities need quality urban rail to solve their traffic problems and at the same time create economic development opportunities in TODs across their cities. Indian cities have such urban rail and TOD goals but like most emerging cities they are at a cross roads with limited funds to implement such goals. Recently, the Government of India has created a new metro rail policy mandating private sector participation to build the urban rail. The new policy has opened up opportunities and challenges which were reviewed in this paper.

The PPP's in four Indian cities were reviewed and for comparison the best PPP model, the Hong Kong MTR. The Indian projects are not doing well apart from the Hyderabad urban rail project which is the only one to involve land development as does Hong Kong. How to make urban rail transit projects more appealing to subdued private investors remains a challenge. The conclusion was that land development based PPP models are likely to be the best way to attract private investments to build urban rail integrated with TOD's. The reviewed pilot cases confirm that Indian cities have a fit case to apply such a PPP model but require an entrepreneurial approach to enable it.

The review analysis confirms that the private sector can add value to PPP's bringing innovation in processes, finance, knowledge, innovation with technologies, managerial efficiencies and an entrepreneurial approach that enables land development to be integrated from the start as the major way of enabling a return on investment. This is the critical step that will bring life and viability to urban rail PPP's.

The public sector can act as a facilitator providing land as part of the development package, land assembly coordination, social responsibility, environmental awareness and local knowledge of amenity and equity needs. This will require community engagement to bring political validation and public outcomes at a local and regional level.

To this end, this paper has conceptualized the RCF based PPP model built on the principles of "Co-Creation." The RCF is structured as a project-level execution framework to shape a Public Private (and People) Partnership to build urban rail along with an integrated land development process. Strategic land asset management, a TOD Plan, business-like governance, VC mechanisms and deliberated stakeholder engagement are core to the RCF approach. The RCF driven win-win collaboration can co-create urban rail projects with private investments and public good outcomes. Thus, the proposed RCF is suggested for other emerging cities as well as Indian cities.

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Conflicts of Interest

The authors declare no conflict of interest.

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