

# **INTRODUCTION**

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The majority of the world's population lives in a city, and this proportion continues to grow. As per World Bank, 66% of the world's population is expected to be urban dwellers by 2050 (United Nations, 2014). For cities to grow it is necessary that robust public transport network is created to support expansion and growth. An efficient public transport is backbone of urbanization. Urban transport is not only to move passengers from one point to another but citizens should have convenient, safe and affordable means to travel from their residences to offices, schools-colleges, markets, places of religion as well as entertainment and to fulfil host of social and professional needs. However, there are negative externalities associated with provision of transit access such as increased pollution through emissions, traffic accidents and congestion. Urban planners have to think how to minimize these externalities while planning to improve access.

Transportation is a driver of economic and social development for the developing world. Promoting sustainable transport contributes to environmental protection, economic growth, and energy security. It could be less expensive just to build additional roads for private cars than to create public transport infrastructure. However, economic necessities dictate need for public transport and the accompanied ecological benefits to the society at large come as a bonus without additional or minimal expenditure.

There are various modes of public transport such as city bus service, light or mono rail, trolley bus, trams, ferries, rope ways etc. Large cities in developed world have built public transport networks which are quite popular among commuters, the rail as well as road based transit systems. While London underground is considered world's oldest metro, Tokyo has crisscross metro lines operated by private and public operators which carry more than 3 billion passengers in a year with Beijing metro fast catching up. Bus based Bus Rapid System (BRT) system of Bogota, Cambodia with dedicated lanes

and metro stations like bus stops built at far less cost than a metro system carries close to 2.5 million people a day more than many metros. In Sao Paolo in Brazil affluent businessmen resort to travel by helicopters to beat chaotic city traffic thereby bringing helicopter also under the definition of a mode of urban transport. Singapore, an example of a vision driven smart public transport system, found a place among top five smart cities of the world in 2015 by Juniper Research which give rankings based on analysis of each city's 'smart' capabilities, using various metrics including smart mobility. Istanbul has a number of ferries and sea buses which carry more than 300,000 persons every year. Many cities in Latin America e.g. Medellin, RioDe Jenerio use aerial ropeways as system for public transport in an urban environment<sup>1</sup>.

While planning a public transport system in a city, the planners have to look at the menu of options available and carry out cost-benefit analysis meticulously taking into account local factors and city's character. Rail based MRTS have higher transport capacity for every rupee invested when compared to road, higher durability and energy efficiency with reduction in environmental pollution. (Borgo, 2012). Roads for equivalent carrying capacity would need double the investment than rail, would need to be rebuilt every ten years twice as frequently as rails and will have a carbon foot print three to four times higher than rails. (Mckinsey, 2010) Metro rail projects require huge capital with long gestation and pay back periods. The cost of construction is high and the cost of operation and maintenance is even higher. Therefore, MRTS are economically feasible in cities where there is huge demand.

“Public transport accounts for only 22 percent of urban transport in India, compared with 49 percent in lower middle-income countries (e.g. the Philippines, Venezuela, Egypt) and 40 percent in upper middle-income countries (e.g. South Africa, South Korea, Brazil)” (MoUD, 2008). The available public transport lacks miserably in quantity as well as quality making commuters wary of using it as a means of transport. This has led to

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<sup>1</sup> Source : <http://www.uitp.org> for figures mentioned in the paragraph

most of the commuters using private vehicles for transit and only the have-nots, having no alternative choice, use public transport.

There is recognition and a greater effort by central government to introduce national level policies which would help in creation of a public transport system which is affordable and sustainable. Formulation of National Urban Transport Policy (NUTP, 2006), introducing Jawaharlal Nehru National Urban Renewal Mission (JNNURM, 2005-14) , constitution of National Transport Development Policy Committee (NTDPC, 2011) were some of the interventions which focussed on improving the state of urban transport in the country. There are plans for integrated approach to urban transport planning and management for which Urban Metropolitan Transport Authority (UMTA) and Urban Transport Fund (UTF) have been envisaged.

Various reports have come out in last few years giving detail projections of investment requirements of various infrastructure sectors including urban transportation. These reports have also highlighted the need for private investment both for financial resources as also for utilizing private sector efficiency and innovative approach to design and implementation. 12<sup>th</sup> Five Year Plan (FYP) envisages a capital expenditure of ` 388,000 crore on urban transport out of which approximately 35% is expected to be funded through private resources. (12th FYP, 2012-17)

The huge investment requirements in infrastructure projects in general and in rail based Mass rapid Transition System (MRTS) in particular can not be individually met by state or central government funding but requires support from private sector entities as also financial institutions, multi-lateral development agencies and others.

While the commitment of state and central government is reflected in the form of policy interventions and allocation of funds, the declining revenue and tighter budgets will make it harder than ever for civic bodies to construct, rebuild, maintain and operate public infrastructure especially rail based MRTS. Hyderabad metro, Gurguram rapid metro and Mumbai metro are through private participation. In order to provide connectivity between

metropolis core and peripheral areas, government has announced three Rapid Rail corridors under Rapid Rail Transit System (RRTS) project, worth 72,700 crore in national capital region of Delhi (NCR) and 49km Mumbai Airport- Panvel line costing 14000 crores. National Capital Region Transport Corporation (NCRTC) with 50% equity by Central Government and 12.5% each by four NCR States of Delhi, Uttar Pradesh, Haryana and Rajasthan has been incorporated to implement these corridors<sup>2</sup>. There is immense potential for private participation to keep pace with urban mobility needs and the growing public demand for efficient and affordable rail based public transportation systems. Public private partnerships (PPPs) are the preferred mode for private sector investment.

Private investment in railways is not a new phenomenon. In fact, railways were originally built and operated by private companies in most parts of the world. However, with time, it became clear that “network economies and reduced scope for competition put railways in a situation where a pure market was not the most beneficial system, and States began to take over their construction and operation”. (Bernardino, 2010)

By the end of last century, governments stretched for budgetary resources started inviting private investment either for building infrastructure or for providing various services. Regulatory frameworks were created to guarantee the performance of private sector and protect the interests of users.

“Overtime, infrastructure projects especially in transport sector have become larger and more complex in terms of the activities bundled into the contractual arrangements, and the number of parties involved in transactions. So the diversity of PPP projects, even in the relatively small number of cases following, is not surprising; it’s to be expected”.(Farrel & Roumboutsos, 2013). “PPP models in railways are still emerging due to complexities involved. Road models cannot be directly applied for railways since rail sector differs significantly from road in terms of technical expertise and level of capital investment.” (Gangwar & Raghuram, 2013)

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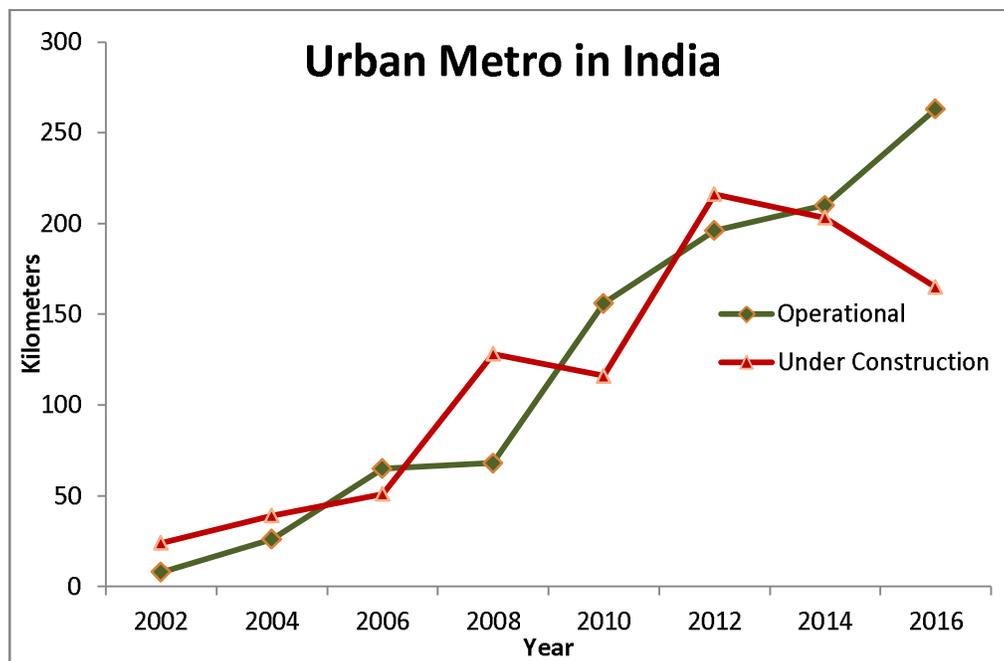
<sup>2</sup>Source NCRTC

World over there is greater recognition that a PPP project that is well structured can deliver more efficiently than a project handled by public sector. However, implementation of public private partnerships requires deft handling on several fronts. Private investment brings in huge benefits to a public project in the form of project, commercial, managerial and technical expertise than public sector. In order to derive maximum benefits from public private partnerships detailed planning and execution is required to minimise the risks as has been learnt from some successful and not so successful PPP experiences across the globe. Critical Success Factor (CSF) methodology, to identify few key areas that influence success of PPP projects, has been applied to PPP projects since 1990 mainly in construction projects but also in other sectors such as education and health sectors. However, there are a very few authors who have applied this methodology to Indian PPPs or more specifically to rail based urban mass transit systems.

## **1.1 BUSINESS PROBLEM**

The high powered expert committee (HPEC) in 2011 has estimated that ` 30,00,000 crores will have to be spent on Urban Infrastructure during next 20 years and relative share of urban transportation of infrastructure spending would be 14.5 % i.e. `4,50,00 crore out of which capital expenditure on rail based MRTS would be `3,60,000 crores. In addition to capital expenditure requirements cited above, HPEC has also estimated that approx 18 lakh crore would be required for operation and Maintenance of Infrastructure in the country in next 20 years. The committee observed that larger share for urban transport is on account of high service backlog which was estimated to be 80% for rail based MRTS and 100% for road based MRTS for Class 1A and 1B cities. (HPEC, 2011). For computation of service backlog, the committee had taken into account the required network lengths for advanced public transport coverage in these cities and in accordance with the National Urban Transport Policy and Urban Transport Service level benchmarks prepared by Ministry of urban Development (MoUD)..

India would require a capital expenditure of ₹ 388,000 crore on urban transport as per 12<sup>th</sup> five year plan projections. The working group has further estimated that only 48% of the finances may come from Central and State Governments and other development agencies and 35% i.e. ₹ 135,000 crore for urban transport projects would be financed by Private Sector. (WG 12th FYP, 2011). Thus a huge amount of private investment is required, even larger than estimated by the working group, given the track record of successive governments, if the wide gaps in current and desired levels of mobility needs are to be bridged.



**Figure 1.1 : Urban Metro in India**

Source : Web site of MoUD

“To meet urban demand India needs to build 350 to 400 kilometres of metros and subways every year more than 20 times the capacity built by India in the past decade” (Mckinsey, 2010). 12<sup>th</sup> FYP advocates “adding rail transit at 10 km/million population, start planning rail transit projects in cities with population in excess of 2 million, start construction in cities with population in excess of 3 million, expand rail transit in existing mega cities, @ 10km/year i.e. 50 KM in 12<sup>th</sup> FYP; provide suburban rail services in urban

agglomerations with population > 4 million.” (WG 12th FYP, 2011). Figure 1.1 gives the metro lines in kilometres constructed and made operational during

**Table-1.1: Sanctioned Indian Metro Projects : Operational or under Construction (As on 31<sup>st</sup> Dec,2016)**

City	Length (Kms)	Cost ( ` Crore)	No. Of Stations	Public/PPP/ Pvt.	Status
Jaipur (Phase-I)	12.067	3149	11	Public	10 Km Operational
Lucknow (Phase-I)	22.88	6928		Public	Under Construction
Nagpur	38.215	8680	36	Public	Under Construction
Kochi	25.612	5181.79	22	Public	Under Construction
Ahmedabad	35.96259	10773	32	Public	Under Construction
Bangalore (phase-I & Phase-II)	112.39	38014	101	Public	Phase-I (30.3 Km) operational
Mumbai Metro -1	11.4	2356	127	PPP	Operational
Mumbai Metro -3	32.5	23136	27	Public	Under Construction
Hyderabad	71.16	12132	64	PPP	Under Construction
Delhi Metro (Phase I, II & III)	349.36	70433	251	Public	Phase III under implementation. Phase I&II operational
Kolkata Metro (Line 1&2)	41.87	7865	36	Public	Line 2 under construction
Chennai Metro*	54.15	18520	33	Public	19.85 Km elevated track operational
Delhi Airport Metro Express	22.7	5700	6	Public-Private	Failed PPP. Under DMRC
Gurgaon Rapid Metro Phase-1 & 2	11.7	1299+2423	11	Private	Operational Phase-2 under construction

Pune Metro Phase-1	31.25	11420	31	Public	Under Construction
Noida	29.7	5064	22	Public	Under Construction

Source: Web sites of respective metros. Annual Reports of MoUD

\*Includes Extension of 9.05 Km approved on 01.06.2016

However the budgetary resources of both Central and State governments are limited and sectors such as health, education etc are to be given priority for budget allocation.

A letter from MoUD to all chief secretaries of states and MDs of Metro Corporations, April 16, 2012 states, “The growth of India has to happen through urbanisation and urbanisation is to be driven by efficient, effective, affordable, quick, comfortable, reliable and sustainable transportation, with the MRTS projects providing the backbone. However the resources through budget are highly limited and cannot be concentrated in few cities alone. As such there is an urgent need to resort to innovative financing mechanism for all MRTS projects.” (MoUD, 2012)

The 12<sup>th</sup> five year plan states, “Given the huge requirement of capital and willingness as well as capability of the private capital to undertake urban transport project, promoting PPP could be a key priority. All metro projects which are in high density corridors, and are viable on their own (with admissible Viability Gap Funding (VGF) and real estate development on land ordinarily required for the project) may be encouraged under PPP mode “(12<sup>th</sup> FYP)

However a glance at the metro projects (Table 1.1) taken up in various Indian cities reveals that other than Hyderabad and Mumbai, no other city has considered PPP for implementing metro project. The metro track planned/constructed under PPP/private comes to only 110 Km of out of total approx 900 km i.e. just 12.3% by track length and 9.3% by project cost. This is an odd situation where state and central government budgets are competing with priority sectors such as health and education, a number of cities are planning for metro projects, private capital has the capability and willingness

to undertake such projects but somehow the public private partnerships are not materialising for such projects.

## **1.2 PROBLEM STATEMENT**

In spite of service backlogs and budgetary constraints of central and state governments and willingness as well as capability of the private capital to undertake rail based urban mass transit system projects, not enough public private partnerships are taking off in such projects required to improve urban mobility for socio economic development of Indian cities.

## **1.3 MOTIVATION/NEED FOR RESEARCH**

“A study of the global experience in urban rail transit by the working group on Urban Transport for 12<sup>th</sup> Five Year Plan has stated that PPPs have not been very successful; the analysis of metro rail systems in 132 cities in the world provides for comprehensive understanding of the ownership structure and use of PPP in metro rail development. In 113 cities having metro rails, 88% have been developed and being operated in public sector mode where in only 12% cities some form of public private partnership exists”. (WG 12th FYP, 2011)

Since PPP's in infrastructure construction was not evolved or was still evolving when most of the metro lines included in the study were constructed, this analysis by working group can hardly be a damning critique. A metro is not very different from an airport in the sense that both involve infrastructure creation and delivery of service. Delhi airport rebuilt through public private partnership is ranked number one in airport service quality among top airports of the world and Mumbai airport was also built by a private consortium on PPP basis. There are successful metro projects built on PPP framework such as Beijing Line 4, South Korea line no 9 and Gautrain in South Africa.

Even where PPP models have not fared well in metro projects, would pure public sector models have fared better? In this context the concluding remarks made in a World Bank report 2005 with reference to two airport links in Australia—Melbourne and Sydney assume special significance. “It is not

clear that the projects would have fared any better off, having avoided at least part of the up-front capital investment; once rail infrastructure investment is sunk the community will typically continue to benefit from the investment irrespective of the financial re-engineering that might be required behind the scenes to try and keep the project going. On the other hand, there is an opportunity cost if PPP structures are used to channel public money into uneconomic projects which might not otherwise have been built. Arguably repeated disappointments with PPP rail projects (such as the two airport links –Melbourne and Sydney) would push up the cost of capital for future PPP rail investments but ultimately it comes down to the specifics of that particular project and the private sector's understanding of, and ability to effectively price, the risks; and equally importantly, the public sector's willingness and ability to move more rigorously to evaluate such proposals." (Williams, Greig, & Wallis, 2005)

As explained above India needs to speed up building metro systems but health, education and such essential public services need priority in allocation of budgetary resources. A huge sum of ` 2, 30,640 crores have been allocated for metro projects operational or under construction (Table 1.1))

There is a school of thought which appose PPP models on the ground that various concessions have to be given for making the project attractive enough for private investment and there is risk of misuse of such concessions. However, the argument is misconceived as even the public metro projects have been supported through lease of land on nominal rate and various duty exemptions, DMRC being a case in point. "The essential feature of railways and the underground is that they are capital intensive industries, which are unable to cover their full costs from fares and so rely on public subsidy for investment. The result is that nationalization and PPPs both represent imperfect solutions to the problem of providing an effective transport system" (Jupe, 2009). The urban planners and policy makers would have to evolve an effective solution to improve urban mobility rather than rejecting PPP in totality

Planning commission has appreciated the fact that commercial utilisation of land is an important resource for metro projects, PPP or public. "An MRTS alignment usually result in a significant rise in value of the real estate along its zone of influence, Government entities promoting metro rail have used this resource to fund other urban infrastructure.....However, given the huge requirement of capital and willingness as well as capability of the private capital to undertake such projects, in high density corridors, projects which are viable on their own (with admissible viability gap funding and commercial utilisation of land ordinarily required for the project) may be encouraged under PPP mode." (12th FYP, 2012-17)

Given the limited budgetary resources of both union and states, India will have to realize that 'One swallow does not make a summer' and will devise strategies to tap private capital and expertise for MRTS projects. Most of the researchers have argued that a public private partnership that has been well structured can deliver better results efficiently than government sector. What is required is the knowledge on how to properly structure a PPP metro project and for this a clarity and focus on what contributes to a successful PPP metro project in Indian context is a prerequisite.

At the theoretical level, the study aims to contribute to the Indian knowledge on PPP by analyzing the critical success factors and their relative importance in influencing the success of PPP metro projects.

At the practical level, the study attempts to develop conceptual framework for success in a PPP metro system in Indian context.

It is believed that the findings of this study will help both public and private sectors to better understand the critical success factors which impact the success of public private partnerships in MRTS, providing valuable information for organizations, both public and private, who intend to participate in PPP initiatives in rail, based urban mass transit systems in India.

#### **1.4 SCOPE OF THE STUDY**

The subject of this study is rail based urban mass rapid transit systems using electric rails in dedicated corridor either elevated or underground with

platforms/stations for boarding/de-boarding of passengers, having an average speed of 30 kmph or more. The scope of the study is limited to rail based mass rapid transit systems (metros) implemented or being implemented in an Indian city on public private partnership framework. Only those PPP arrangements for metro are included where private sector entity brings in investments and/or undertakes management for a specified time period sharing substantial risk in the project for which it is entitled to collect user charges and/or receive performance linked payments. While the three Indian metros namely; Delhi airport metro express line, Hyderabad metro and Mumbai metro line-1 developed on a PPP framework have been covered, Gurugram rapid metro has been excluded for the sake of homogeneity being a fully privately financed metro system where the Haryana Government has only provided right of way on lease hold basis.

## **1.5 OVERALL METHODOLOGY OF THE STUDY**

Based on elaborate literature review and consultation with industry professionals and academicians, the research issues are identified. This is followed by a review of available research work in the area to identify the research variables. A suitable research methodology was planned based on deductive as well as inductive approaches. This was followed by the conduct of research, analysis of results and drawing inferential conclusions to address the research issues identified.

Pilot study where a select group of experts in the domain of research were contacted for clarity on research variables identified in the literature review and their contextual relationships. Pilot study also helped in testing the research instrument for its validity and reliability.

A questionnaire based survey was conducted to gain a broad insight into the perception of the private and public sector stakeholders of a PPP metro on critical success factors that contribute to the success of a PPP metro project in Indian context. The questions were carefully formulated based on the literature review, other questionnaires, and consultation with domain experts to capture perception of both sectors of stakeholders. Analysis of the

data led to confirming the significance of the critical success factors and grouping them into few key macros. Suitable statistical methods were used to capture the difference of opinion among private and public sector stakeholders regarding the significance of various critical success factors in contributing to the success of a PPP metro in India. These macros were further studied in a real life setting of one of the Indian PPP metros (Hyderabad Metro) applying SAP-LAP methodology to get better insights into situational factors and the role of various actors in the performance of a PPP metro.

The findings of the opinion survey and SAP-LAP study helped in revisiting the conceptual framework. This was further validated empirically using statistical methods to evolve a framework applicable to Indian PPP metros.

The learning from all the phases of the study; literature survey, pilot study, opinion survey and SAP LAP study were synthesized with the work done by earlier researchers. This integrated learning led to a validated framework for implementation of a PPP metro in Indian context with key learning issues highlighted for future metro projects.

## **1.6 ORGANIZATION OF THE THESIS**

The thesis is divided into nine chapters. Chapter one contains an introduction to urban metro and its increasing significance in improving urban mobility in developing cities. This chapter also discusses the relevance of public private partnerships in the context of Indian urban metro. Looking at the completed and ongoing metro projects in the country the chapter poses a question as to why not enough partnerships are taking place in this space leading to the definition of the business problem for the study. Subsequently, the need for research in the area is discussed, the scope of the study defined and the overall methodology for the study is outlined. Finally, an overview of the chapter scheme of the thesis has been reported in this chapter.

Chapter two deals with the literature review on public private partnerships in urban metros. Available literature has been classified under following areas; urban transport and metro rapid transit systems , what are

PPPs and existing framework on PPP, PPP in urban transport, critical success factors (CSFs) , risk analysis and risk management in PPP projects, what defines success of a PPP metro project, Indian experience with PPP metros and SAP-LAP Analysis.

Considering that a critical appraisal of Indian experience with PPP metro deserves to be dealt with in detail to get a thorough understanding of practical issues and reality, a separate chapter has been devoted to this part of explorative and qualitative research i.e. Chapter three.

Chapter four presents the design of the study and details research methodology. Definitions of the important research variables, research propositions, and conceptual framework are explained and research questions and objectives are spelt out. A step-by-step research methodology details sampling design, research instrument design and the methodology for pilot study and opinion survey and hypothesis of association and hypothesis of difference. Objective research methods used have been tabulated and justification of the methodology chosen is also provided in this chapter.

In chapter five, details of pilot study is presented. The chapter gives details of the methodology followed for the pilot study. Primary data was collected through a structured questionnaire to a select sample of respondents considered experts in the field of public private partnerships in railways/metros. Pilot Study helped in testing the reliability and validity of the research instrument before it was administered to a larger group of respondents for opinion survey. Objective-1 of the study was achieved by establishing significance of one set of research variables i.e. performance indicators for success of a PPP metro. Pilot study data was also used to evaluate which CSFs are impacting which performance indicators.

Chapter six titled “Analysis and Results” brings out statistical analysis of the data for opinion survey and discussion on findings. The chapter also deals with refinement and empirical validation of the conceptual framework for a PPP metro through hypotheses testing for macro variables using regression analysis. Similarly null hypothesis that there is no significant

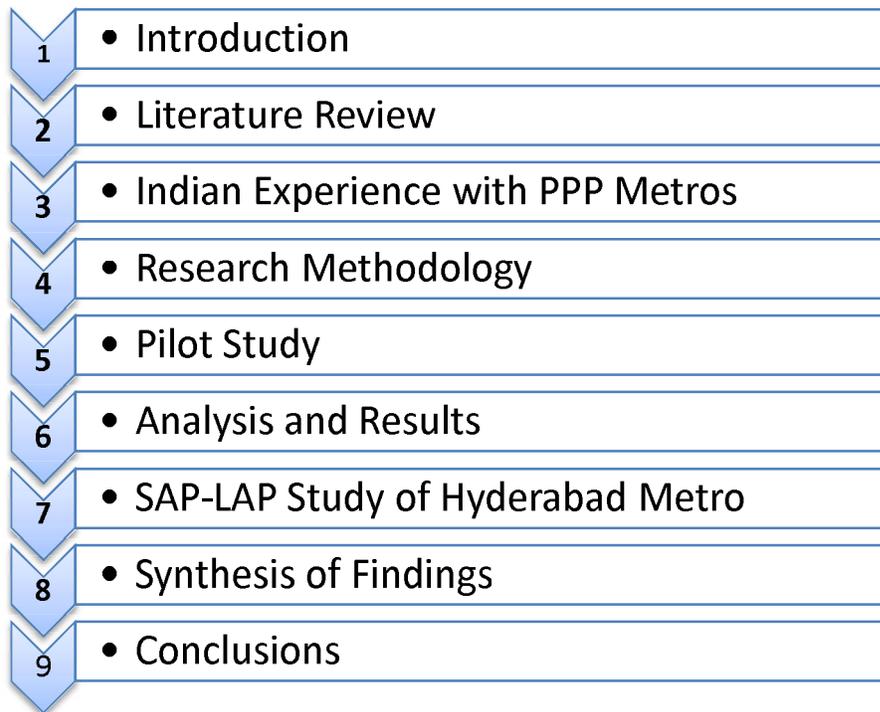
difference in the perception of private and public sector stakeholders of a PPP metro in the country is also validated through suitable statistical tools.

In chapter seven SAP-LAP analysis of one of three PPP metros in India namely Hyderabad Metro have been presented. The SAP-LAP assessment framework is used to analyze the identified CSFs in real-life settings of Hyderabad metro. A field study was conducted by obtaining feedback through semi structured interviews of key players on various actions performed on critical factors and learnings have been highlighted for synthesis with the other findings of the study.

Chapter eight presents the key learning and key implementation issues, arising out of the research work. Major learning from the literature survey, Pilot Study, Opinion Survey and SAP-LAP study have been synthesized to get clarity on the significance of critical success factors in contributing to the success of a PPP metro in Indian context.

In Chapter nine which is the last chapter concludes the findings of research work. The chapter also briefly highlights the contribution made by the present study and suggestions for future research on the subject.

The organization of thesis chapter-wise is presented schematically in Figure-1.2.



**Figure 1.2 : Organisation of Thesis**

## **1.7 CONCLUDING REMARKS**

Transportation is essential for social and economic development of the modern urban world. Rail based metro systems are increasingly finding favours with city planners as a solution to improve urban mobility and to deal with chaotic road traffic and congestion. However rail based metros are capital intensive and budgetary resources compete with other priority sectors. Private sector has the willingness and capability to invest and execute complex metro projects. PPPs are the preferred mode of private sector participation. However, not enough public private partnerships are taking place in this area and space. This business problem has been well defined in this first chapter of the study supported by the data from Indian metros implemented or under implementation. The scope of the study and the overall methodology for the study has been outlined. Finally, an overview of the chapter scheme of the thesis has been presented. The next chapter covers the literature review of the relevant areas related to the study.