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Delhi Metro Rail Project: A Case Study of India's first of its kind urban infrastructure megaproject

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Evidence suggests that infrastructure megaprojects often suffer significant cost overruns, while also being unable to fully meet their projected benefits. (Siemiatycki, 2006). Against seemingly impossible odds in a country known for unimplemented urban plans (Kulabkar, 2002), the Delhi metro rail was made a reality — attracting political cooperation, raising more than \$2.4 billion in development funds, and building the initial phases of the metro on time and within budget.

Rashmi Sadana (2012) posits the metro as a new kind of public space, urban technology, and part of the city's landscape. The Delhi metro merged function with form becoming the intersection of mass mobility and mass/popular culture (Siemiatycki, 2006). The development of the Delhi metro involved broad range of economic and political management, land appropriations, slum clearances, etc. In this case study, we will explore the ways in which the Delhi Metro Rail Corporation (DMRC), a public sector organisation, has been successful in managing project timelines and costs. The attempt is to understand both tangible and intangible variables that contributed towards phases of ideation, planning, management, and execution. Focussed on the first few phases of its construction, we attempt to highlight:

- Creating and upholding high process standards facilitating successful project execution.
- Streamlining the contentious process of land acquisitions.
- Facilitating inclusion of vulnerable groups and non-title holders in the R&R (resettlement and rehabilitation) process.
- Inculcating a sense of responsibility, work ethic, and convergence of efforts.

Evidence from early construction stage: Linear vision and clarity of process

In May 1995, the Delhi Metro Rail Corporation Limited (DMRC) was registered as a joint venture between the Ministry of Urban Affairs and the Government of NCT of Delhi (GNCTD) for implementation and operation purposes. It was in December 2002 that DMRC begin its operation with an 8-kilometre line (CAG, 2008; CPI, 2017).

The Delhi metro rail was, in the words of the former metro chief E. Sreedharan, “a railway project”, thereby indicating a singular focus on construction and engineering aspects of the project.

In 1994, as a starting point for the project operation, a detailed Environmental Impact Assessment (EIA) was carried out to gauge and minimize negative environmental impacts of the project during the construction stage. Site environmental plans for each contract were drawn. The ISO14001 EMS certification was supported by internal and external audits and an independent team of metro officers was constituted to ensure implementation of environmental procedures for the management of air and dust, noise and vibration, water and wastewater and construction waste.

Consequently, DMRC became the first metro in the world to receive 14001 certifications at the construction stage and only the second metro in the world after the New York metro to be ISO 14001 certified. Environmental procedures for hazardous waste management, soil and land management, handling chemicals and toxic materials, landscape and aesthetics were put into effect (Verma, 2008). The DMRC has also been awarded OHSAS 18001 (Occupational Health and Safety Assessment sequence 18001) by Registro Italiano Navale India Pvt. Ltd. (RINA), Genova.

Streamlined land appropriation mechanisms

DMRC acquires land from Government agencies such as Delhi Development Authority (DDA), Municipal Corporation of Delhi (MCD) and Ministry of Urban Development (MoUD) etc. on a lease basis. Private land is acquired by DMRC under Land Acquisition Act, 1894, through Land Acquisition Collector, Government of National Capital Territory of Delhi (GNCTD).

According to the Environmental Impact Assessment report of Phase I of the Delhi Metro, the project required 348.45 hectares of land and needed to relocate 2,502 *Jhuggies* (Hazards Centre, 2006). Eviction and relocation of Jhuggies took place with the development of the Delhi Metro, which acquired large tracts of land along its lines.

A legal framework gave the DMRC an unencumbered right to acquire land it deems necessary for metro operations – Delhi Metro Railway Operation and Maintenance Act, 2002. As per the policy provisions, the DDA will rehabilitate the PAFs (Project Affected Families) occupying residential dwelling units on the recommendation of the Land Acquisition Commissioner (LAC) and approval of the Land & Building Department (L&B), Government of National Capital of Delhi (GNCTD) and DMRC will rehabilitate PAPs (Project Affected Persons) occupying commercial unit/shop by providing constructed shop in the shopping complex.

The compensation payable to the landowner includes not only the cost of land but also the cost of structures existing on the acquired land. DMRC deposits 80% compensation as and when demand is received from the concerned Land Acquisition Collector after issuing of notification. As and when the Land Acquisition Collector announces the Award, balance payment is deposited by DMRC. The reimbursement of compensation to the affected persons is paid by the concerned Land Acquisition Collector.

Inclusion of non-title holders for compensation and rehabilitation

The framework adopted for rehabilitation, and compensation entitled a variety of PAPs (Project Affected Persons) and PAFs (Project Affected Families) including non-title holders (squatters), tenants, kiosk owners, etc.

As per the 'Policy/Guidelines on Relocation and Rehabilitation of the PAPs of All Categories due to Implementation of Delhi MRTS project', the PAPs (Project Affected Persons) entitled for compensation and rehabilitation are:

- (i) PAPs losing land and other assets with legal title/traditional land rights will be compensated, and PAPs will be rehabilitated
- (ii) Tenants in case of shops
- (iii) Owners of buildings, or other objects attached to the land
- (iv) PAPs losing business, income, and salaries
- (v) Assistance to the **non-title holders (squatters, etc)**.

The mitigation measure of the adverse impacts included the following:

- (i) To assist the PAPs (Project Affected Persons) in resettling them at the suitable place.
- (ii) To provide monetary assistance in the form of shifting allowance and transitional allowance, etc.

(iii) To provide house for loss of house at resettlement site by Delhi Development Authority (DDA).

Entitlement Matrix		
Category of Loss	Relocation & Rehabilitation Policy in respect of PAPs for all categories due to implementation of Delhi MRTS Project	Responsible Agency
Loss of ownership of land	The price for acquisition of land is determined on the basis of market value.	District Collector Govt. of NCT
Loss of ownership of house	<ul style="list-style-type: none"> • DDA is responsible for rehabilitation of PAPs. • A LIG flat for PAFs loosing plot size less than 100sq.m. • A MIG flat for PAFs loosing plot size more than 100sq.m. • Rs.7882/- per Sq.m. for construction cost 	District Collector, DDA Govt. of NCT
Loss of ownership of shop	<ul style="list-style-type: none"> • DMRC is responsible for rehabilitation of PAPs • Construction of shops • Maximum size of 15 sq.m per PAP • Rs.7882/-per sq.m. for construction cost 	District Collector Govt. of NCT DMRC
Tenant in case of residential unit	Compensation for shifting expenses a sum of Rs 10,000/- to be paid to each household unit	Project Authority
Tenant in case of shops	Eligible for rehabilitation	Project Authority
Relocation of Kiosk	Shifting allowance @ Rs 10,000/- Project Authority	Project Authority
Vulnerable affected person	Skill improvement training to be arranged and assistance of Rs 15,000/- (LS)	Project Authority
Cost of Trees	Current market rate	Project Authority
Crop Compensation	Current market value, if acquired between crop season	Project Authority

Source: Social Impact Assessment for Proposed Metro Depot at Badli, Delhi. Centre for Environment Research and Development.

Convergence & Commitment

From the beginning of the project, making funding available for the project's four phases was key to its success. The DMRC enjoyed the freedom to be able to take technical decisions independently and relied on the government principally for arranging funding and land acquisition. The former metro chief, E. Sreedharan collaborated with the Japanese International Cooperation Agency (JICA) to introduce the Japanese work ethic into the MRT project design. The JICA specifically set technical guidelines on the selection process for contractors as a condition of their funding. These allowed the DMRC "to accept only the bid of the bidder with the highest technical rank, with an exception only if the financial estimate of this bidder was unreasonably high". Such procedures helped to reduce interference from bureaucrats and politicians who had a vested interest in awarding contracts according to other criteria. (Center for Policy Impact, 2017; Siemiatycki, 2006)

As the DMRC entered into the implementation phase, a business model was devised based largely on outsourcing engineering and construction functions. In order to make such endeavours enticing to the private sector, it became necessary to promote a sense of efficiency and imminence that defied the typical Indian public sector project. To achieve this goal, the development time frame set out by the government was compressed from 10 to 7 years (Sreedharan, 2002), inculcating a sense of urgency.

Siemiatycki (2006) describes that as a constant reminder, clocks counting down the seconds until the project was set to be inaugurated were given to each employee and displayed at many work sites. This perpetual state of urgency made it appear reasonable for the DMRC and contractors to push workers to their physical limits, thus extracting maximum profits. This development approach has contributed to the first phase of the metro being delivered on time and on budget, a feat that defies the norm for Indian public sector infrastructure projects and the international experience of seemingly endemic cost overruns associated with building urban rail systems.

Lastly, during the planning period and Phase I, international expertise from the US, France, Korea and Japan was used. To make the project sustainable, the DMRC engaged Indian firms that would later be able to implement the MRT project without significant foreign input. International firms provided their know-how for specific tasks such as station design, construction management, and rolling stock production. These partners "were required to partner and transfer their expertise to Indian firms, so that indigenous companies could take a lead role in the later stages of the Delhi Metro project" (Center for Policy Impact, 2017; Siemiatycki, 2006).

During the project, engagement with local authorities remained important, especially regarding the coordination of underground segments of the metro that required local authorities to move underground water pipes and sewage networks and carry out other excavations. Initially, "other agencies were reluctant to cooperate, and this delayed construction in stretches of ground utility infrastructure because utilities could not be shifted". To address this issue, DMRC offered to conduct the work themselves (see also Alignment below) while involving agencies "through the preparation and submission of detailed plans for approval". Sreedharan admitted that "all the works which the civic authorities are required to do, we did it ourselves without waiting for them. If a huge water pipeline is to be shifted, they would take 2 years for that. Whereas we were able to get it done in 30 days" (Center for Policy Impact, 2017; Siemiatycki, 2006).

Conclusion

Sustained support for infrastructure mega projects stems from the way that such projects are presented to the public. The story of Delhi metro demonstrates how building a favourable image that combines tangible elements with intangible symbolic meanings may galvanise public support and draw clients to a public transportation system (Siemiatycki, 2006).

The Delhi MRT project has received strong public support throughout, owing to the DMRC's ability to persuade people of the metro's benefits through a clear and well-planned public relations approach. Fearing that an unfavourable press could quickly turn public opinion against them, the DMRC engaged in open and active media relations. Open engagement with media outlets amplified direct engagement with the public and the "DMRC was able to have a voice in public discussions, thus presenting aspirations of the metro as a transformational force for Delhi and offering the metro as a point of pride for Delhi-ites" (Center for Policy Impact, 2017). To keep the public informed and establish a positive and transparent picture of the MRT project, all construction phases were systematically addressed in the media. The aim was to build public confidence gradually by creating an image that would "generate a sense of public pride, ownership and respect" (Center for Policy Impact, 2017).

The efficient operational aspects of the Delhi MRT projects alongside a well-planned and executed public relation strategy makes it a success story.

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