

**CONSTRUCTION PROJECT PERFORMANCE
METRICS: CONCEPTUALIZATION,
MEASUREMENT AND APPLICATION IN METRO
RAIL**

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CONSTRUCTION PROJECT PERFORMANCE METRICS: CONCEPTUALIZATION, MEASUREMENT AND APPLICATION IN METRO RAIL

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DEDICATION

*This piece of research is a heartfelt and loyal endowment to the presence of
the promised savior of human beings,*

“IMAM MAHDI (p. 6 .h)”

*whose appearance is
acme of knowledge, evolution of mankind and bliss of humanity.*

I dedicate this entire effort and my life to his Holiness.

I wish I'll be counted among his companions.

CERTIFICATE

This is to certify that the thesis entitled “**Construction Project Performance Metrics: Conceptualization, Measurement and Application in Metro Rail**” being submitted by Ms. **Zeinab Karimi** to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy is a bonafide record of the research work carried out by her under our supervision and guidance. The thesis work, in our opinion, has reached the requisite standard, fulfilling the requirements of the said degree. The results contained in the thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.

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In the name of God, the Beneficent, the Merciful.

Praise be to God, Lord of the Worlds.

How poor is a man when he finds himself incapable of a worthy appreciation to Almighty GOD. How beautiful the great poet of Persia, Saadi Shirazi, describe it; “Laudation to the GOD of majesty and glory obedience to him is cause of approach and gratitude in increase of benefits. Every inhalation of the breath prolongs life and expiration of it, gladdens our nature. Wherefore every breath confers two benefits and for every benefit gratitude is due. Whose hand and tongue is capable to fulfill the obligation of thanks to him?”

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ABSTRACT

Construction is an important industry in Iran and India. There are very few researchers that studied in the area of construction management as far as metro rail construction is concerned. The focused research on this sector in Iran and India would help in understanding the causes of slow improvement in performance. This study is an exploratory work in Islamic Republic of Iran and Republic of India that attempts to identify and evaluate the success factors and performance indicators in this sector. That would form a guideline for further studies and it will help professionals to understand some important factors which impact metro construction project performance and also provide them a tool to evaluate the performance of the projects with the focus on such factors. The success factors are identified and classified based on literature survey. The factors are classified into four groups namely; project participant related factors, organizational tactics and strategies, environmental factors, and project characteristic factors. The questionnaire survey is adopted to collect the data for this research.

This research tried to look into objectives. The first objective is to identify the important factors influencing project performance and their relative importance. The Exploratory Factor Analysis (EFA) followed by Confirmatory Factor Analysis (CFA) is conducted on the data. The result shows *project manager leadership* is the most important factor under project participants group in Iran and India. In case of organizational tactics and strategies group, the most important factor is *conducting safety program* in metro construction in Iran and *project mission* in case of India. Similarly, *accessibility of transportation* is the important success factor in metro construction in Iran while *political and economic situation* is the most important factor in India. Finally, under the project characteristic group, the most important factor in Iran and India are *nature of project* and *urgency of project* respectively.

The second objective of the research is to identify the indicators for metro rail project performance in Iran and India. The CFA, Interpretive Structural Modeling (ISM) and Structural Equation Modeling (SEM) are applied in to fulfill this objective. The result of the analysis reveals the performance indicators and their relative importance for each country. Further analysis shows the safety performance is not significantly related to overall performance in both countries.

The third objective of the research is to find out the enablers and inhibitors of the metro rail construction projects in Iran and India. These variables are identified by open ended questionnaire and analyzed through ISM technique. This analysis clearly shows the enabler and inhibitors specifically related to local industry in each country and their driving and dependency powers.

Finally, Analytical Hierarchy Process (AHP) has been applied to address the last objective of the research. The fourth objective is to develop a Project Performance Index (PPI) to evaluate the performance level of the construction project.

The findings of the research will help the project managers and other decision makers in construction industry in Iran and India to assist in enhancing the metro construction performance in a most effective and efficient way.

Key words:

Metro Rail Construction Projects, Performance Indicators, Success Factors, Enablers, Inhibitors, Project Performance Index (PPI), Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Interpretive Structural Modeling (ISM), Structural Equation Modeling (SEM), Analytical Hierarchy Process (AHP), Delhi Metro Rail Cooperation (DMRC), Tehran Urban and Suburban Railway Company (TUSRC).

CONTENTS

	Page
Dedication	li
Certificate	iii
Acknowledgment	iv
Contents	viii
List of Figures	xiv
List of Tables	xvi
 CHAPTER 1	 INTRODUCTION
1.1 Introduction	1
1.2 Metro rail construction Background	1
1.2.1 Tehran Metro Rail	8
1.2.2 Delhi Metro Rail	10
1.2.3 Worldwide Rank of Iran and India Metro System	14
1.2.4 Benefits of Metro System	14
1.3 Motivation for The Research	15
1.4 Research Objectives	16
1.5 Scope of Research	16
1.6 Organization of The Thesis	17
 CHAPTER 2	 LITERATURE REVIEW
2.1 Introduction	19
2.2 Construction Project	20
2.3 Construction Project Success	22
2.4 Factors Influencing Project Performance	25
2.4.1 Project Participant related Factors	34
2.4.2 Organizational Tactics and Strategies	35
2.4.3 Environmental Factors	37
2.4.4 Project Characteristic Factors	37
2.5 Evaluation of Project Performance	38
2.6 Key Performance Indicators	47
2.6.1 Time	47
2.6.2 Cost	47

2.6.3	Quality	47
2.6.4	Satisfaction	48
2.6.5	Health and Safety	48
2.6.6	Productivity	50
2.6.7	Dispute Avoidance	50
2.7	Project Success Index	50
2.8	Analytical Model Used	51
2.9	Literature Gaps and Motivation for Research	55
2.1	Conclusion	55

CHAPTER 3 RESEARCH METHODOLOGY

3.1	Introduction	57
3.2	Questionnaire Survey	60
3.2.1	Development of First Stage Questionnaire	61
3.2.2	Development of Second Stage Questionnaire	63
3.2.3	Pilot Survey	64
3.2.4	Sampling for Main Survey	65
3.3	The Main Survey	67
3.3.1	Responses Received	67
3.3.2	Respondent's Profile	67
3.4	Analysis Techniques	68
3.4.1	Bivariate Analysis	68
3.4.2	Multivariate Analysis	69
3.4.3	Multi Criteria Decision Making Methods	77
3.5	Conclusion	79

CHAPTER 4 IDENTIFICATION OF SUCCESS FACTORS FOR METRO CONSTRUCTION PROJETS

4.1	Introduction	81
4.2	Project Participant Related Factors	82
4.2.1	Conducting EFA on Project Participant related Factors in Iran	83
4.2.2	Conducting CFA on Project Participant Related Factors in Iran	86
4.2.3	Conducting EFA on Project Participant Related Factors in India	88
4.2.4	Conducting CFA on Project Participant Related Factors in India	91

4.3	Organizational Tactics and Strategies	92
4.3.1	Conducting EFA on Organizational Tactics and Strategies in Iran	93
4.3.2	Conducting CFA on Organizational Tactics and Strategies in Iran	96
4.3.3	Conducting EFA on Organizational Tactics and Strategies in India	97
4.3.4	Conducting CFA on Organizational Tactics and Strategies in India	100
4.4	Environmental Factors	102
4.4.1	Conducting EFA on Environmental Factors in Iran	102
4.4.2	Conducting CFA on Environmental Factors in Iran	105
4.4.3	Conducting EFA on Environmental Factors in India	106
4.4.4	Conducting CFA on Environmental Factors in India	109
4.5	Project Characteristics	110
4.5.1	Conducting EFA on Project Characteristics in Iran	110
4.5.2	Conducting CFA on Project Characteristics in Iran	112
4.5.3	Conducting EFA on Project Characteristics in India	113
4.5.4	Conducting CFA on Project Characteristics in India	114
4.6	Conclusion	116
CHAPTER 5 PERFORMANCE MEASUREMENT INDICATORS OF METRO CONSTRUCTION PROJECTS		
5.1	Introduction	121
5.2	An Evaluation of Performance Indicators	121
5.2.1	Cost Performance (CP)	121
5.2.2	Time Performance (TP)	123
5.2.3	Quality Performance (QP)	125
5.2.4	Health and Safety	126
5.2.5	Disputes Avoidance	126
5.2.6	Productivity	127
5.2.7	Satisfaction	127
5.2.8	Identifying the Principal Performance Indicators in Iran	128
5.2.9	Metro Construction Project Performance Indicators in Iran	132

5.2.10	Identifying the Principal Performance Indicators in India	134
5.2.11	Metro Construction Project Performance Indicators in India	138
5.2.12	Performance amassment based on Metro Construction Project Performance Indictor	140
5.3	Qualitative Interrelationship Between Performance and Group Factors in Iran	143
5.4	Qualitative Interrelationship Between Performance and Group Factors in India	146
5.5	Quantitative Interrelationship Between Performance and Group Factors in Iran	148
5.6	Quantitative Interrelationship Between Performance and Group Factors in India	150
5.7	Conclusion	154
CHAPTER 6 SYSTEM MODELING OF ENABLERS AND INHIBITORS IN METRO CONSTRUCTION PROJECTS		
6.1	Introduction	155
6.2	Interpretive Structural Modeling (ISM)	155
6.3	Enablers of Metro Construction Projects in Iran	156
6.3.1	Structural Self-Interaction Matrix (SSIM) for Enablers in Iran	157
6.3.2	Reachability Matrix for Enablers in Iran	157
6.3.3	Level Partitions for Enablers in Iran	159
6.3.4	Formation of ISM- based model for Enablers in Iran	159
6.3.5	Driver-Dependency Map for Enablers in Iran	160
6.4	Enablers of Metro Construction Projects in India	163
6.4.1	Structural Self-Interaction Matrix (SSIM) for Enablers in India	163
6.4.2	Reachability Matrix for Enablers in India	164
6.4.3	Level partitions for Enablers in India	165
6.4.4	Formation of ISM- based model for Enablers in India	166
6.4.5	Driver-Dependency Map for Enablers in India	166
6.5	Inhibitors of Metro Construction Projects in Iran	170
6.5.1	Structural Self-Interaction Matrix (SSIM) for Inhibitors in Iran	170
6.5.2	Reachability matrix for Inhibitors in Iran	171
6.5.3	Level partitions for Inhibitors in Iran	172

6.5.4	Formation of ISM- based model for Inhibitors in Iran	173
6.5.5	Driver-Dependency Map for Inhibitors in Iran	173
6.6	Inhibitors of Metro Construction Projects in India	175
6.6.1	Structural Self-Interaction Matrix (SSIM) for Inhibitors in India	176
6.6.2	Reachability matrix for Inhibitors in India	176
6.6.3	Level partitions for Inhibitors in India	177
6.6.4	Formation of ISM- based model for Inhibitors in India	178
6.6.5	Driver-Dependency Map for Inhibitors in India	178
6.7	Conclusion	181
CHAPTER 7 FRAMEWORK FOR DEVELOPMENT OF PROJECT PERFORMANCE INDEX		
7.1	Introduction	183
7.2	PPI Development in Metro Construction Projects In Iran	187
7.2.1	Equations for Individual Performance Indicators in Iran	189
7.2.2	Performance Sensitivity Analysis Graph for Iran	190
7.2.3	Gradient Sensitivity Analysis Graph for Iran	191
7.3	PPI Development in Metro Construction Projects in India	197
7.3.1	Equations for Individual Performance Indicators in India	198
7.3.2	Performance Sensitivity Analysis Graph for India	198
7.3.3	Gradient Sensitivity Analysis Graph for India	199
7.4	Correlation Between PPI and Metro Construction Project Performance in Iran and India	204
7.5	Conclusion	205
CHAPTER 8 SUMMARY AND CONCLUSION		
8.1	Introduction	207
8.2	Summary	207
8.3	Important Findings and Conclusions	208
8.4	Contributions	213
8.5	Limitations	215
8.6	Recommendations For Future Research	215
8.7	Implications of The Research	217
8.7.1	Implications for Practitioners and Professionals	217

8.7.2	Implications for Academics	218
8.8	Concluding Remarks	219
CHAPTER 9	REFERENCES	220
APPENDICES		
A	Main Questionnaire	239
B	Questionnaire for AHP Methodology in Iran	249
C	Questionnaire for AHP Methodology in India	257
	About the Researcher	263

LIST OF FIGURES

1.1: Tehran Urban & Suburban Railway (Metro) Map	3
1.2: Delhi Metro Rail Network	5
2.1: Mapping the literature	20
2.2: Micro and macro viewpoints of project success by Lim and Mohammed (1999)	23
2.3: The four dimensions of project success by Shenhar et al. (1997)	24
2.4: Measuring project success by Atkinson (1999)	38
2.5: Square Route by Atkinson (1999)	39
2.6: Consolidated framework for measuring project success by Chan and Chan (2004)	42
2.7: KPIs for project success by Chan and Chan (2004)	43
2.8: Performance measurement criteria for mega projects (Toor and Ogunlana, 2010)	44
2.9: Theoretical performance model by Blindenbach-Driessen (2006)	45
2.10: Project success components based on Baccarini (1999)	45
2.11 Criteria for project success (Chan <i>et al.</i> , 2002)	46
2.12: Model of Project Success by Chua <i>et al.</i> (1999)	54
3.1: Research methodology and techniques	59
3.2: Path Analysis Model	73
3.3: Confirmatory factor analysis (CFA)	74
3.4: Structural Equation model (SEM)	75
4.1: Scree plot for project participant related factors in Iran	85
4.2: CFA on project participant related factors in Iran	87
4.3: Scree plot for project participant related factors in India	90
4.4: CFA on project participant related factors in India	91
4.5: Scree plot for organizational tactics and strategies in Iran	94
4.6: CFA on organizational tactics and strategies in Iran	96
4.7: Scree plot for organizational tactics and strategies in India	99
4.8: CFA on organizational tactics and strategies in India	101
4.9: Scree plot for environmental factors in Iran	103
4.10: CFA on environmental Factors in Iran	105
4.11: Scree plot for environmental factors in India	107
4.12: CFA on environmental factors in India	109
4.13: Scree plot for project characteristics in Iran	111
4.14: CFA on project characteristic factors in Iran	112
4.15: Scree plot for project characteristic factors in India	114
4.16: CFA on project characteristic factors in India	115
5.1: Responses for cost overrun reasons in Iran	123

List of Figures Contd...

5.2: Responses for cost overrun reasons in India	123
5.3: Responses for Time overrun reasons in Iran	124
5.4: Responses for Time overrun reasons in India	124
5.5: Scree plot for performance indicators in Iran	129
5.6: CFA on performance indicators in Iran	133
5.7: Scree plot for performance indicators in India	135
5.8: CFA on performance indicators in India	139
5.9: ISM-based model for performance and group factors in Iran	145
5.10: ISM-based model for performance and group factors in India	148
5.11: SEM on performance and group factors in Iran	149
5.12: SEM on performance and group factors in India	152
6.1: ISM-based model for enablers of metro construction in Iran	160
6.2: Driving power and dependence diagram for enablers in Iran	162
6.3: ISM-based model for enablers of metro construction in India	167
6.4: Driving power and dependence diagram for enablers in India	169
6.5: ISM-based model for Inhibitors of metro construction in Iran	173
6.6: Driving power and dependence diagram for Inhibitors in Iran	174
6.7: ISM-based model for Inhibitors of metro construction in India	179
6.8: Driving power and dependence diagram for Inhibitors in India	180
7.1: Hierarchical structure developed for metro construction project performance in Iran	188
7.2: Performance sensitivity analysis graph	190
7.3: Gradient Sensitivity Analysis for Quality	191
7.4: Gradient Sensitivity Analysis for Time/Productivity	192
7.5: Gradient Sensitivity Analysis for Safety	193
7.6: Gradient Sensitivity Analysis for Satisfaction	194
7.7: Gradient Sensitivity Analysis for Cost	195
7.8: Gradient Sensitivity Analysis for Dispute Avoidance	196
7.9: Hierarchical structure developed for metro construction project performance in India	197
7.10: Performance Sensitivity Analysis	199
7.11: Gradient Sensitivity Analysis for Satisfaction	200
7.12: Gradient Sensitivity Analysis for Safety	201
7.13: Gradient Sensitivity Analysis for Dispute Avoidance	202
7.14: Gradient Sensitivity Analysis for Time/Cost	203

LIST OF TABLES

1.1: The percentage of projects with cost and time overruns in India	7
1.2: Worldwide rank of Iran and India metro system	14
1.3: Metro rail system in Iran and India	17
2.1: Construction project success factors (based on literature)	32
2.2: Rational and Incremental approaches to strategic management	35
2.3: Parameters in square root to measure success criteria by Atkinson (1999)	40
2.4: Project Success Indicators/ Criteria: The References	49
2.5: Analytical models used in previous studies	53
3.1 summary of responses sorted on categories of respondents	68
4.1 KMO and Bartlett's Test for project participant related factors in Iran	83
4.2: Total variance explained for project participant related factors in Iran	84
4.3: Rotated component matrix for project participant related factors in Iran	85
4.4: Standardized regression weights for project participant related factors in Iran	88
4.5: Fit Indices for the project participant related factors in Iran	88
4.6: KMO and Bartlett's Test results for project participant related factors in India	89
4.7: Total variance explained for project participant related factors in India	89
4.8: Rotated Component Matrixa for project participant related factors in India	90
4.9: Fit Indices for project participant related factors in India	92
4.10: Standardized regression weights for project participant related factors in India	92
4.11: KMO and Bartlett's Test results for organizational tactics and strategies in Iran	93
4.12: Total Variance Explained for organizational tactics and strategies in Iran	94
4.13: Rotated Component Matrixa for organizational tactics and strategies in Iran	95
4.14: Regression weights for organizational tactics and strategies in Iran	97
4.15: Fit Indices for organizational tactics and strategies in Iran	97
4.16: KMO and Bartlett's Test for organizational tactics and strategies in India	98
4.17: Total Variance Explained for organizational tactics and strategies in India	98
4.18: Rotated Component Matrixa for organizational tactics and strategies in India	99
4.19: Fit Indices for the organizational tactics and strategies in India	101
4.20: Standardized regression weights for organizational tactics and strategies in India	101
4.21: KMO and Bartlett's Test for environmental factors in Iran	102
4.22: Total Variance Explained for environmental factors in Iran	103
4.23: Rotated Component Matrixa for environmental factors in Iran	104
4.24: Fit Indices for environmental factors in Iran	105
4.25: Standardized regression weights for environmental factors in Iran	106
4.26: KMO and Bartlett's Test for environmental factors in India	106

List of Tables Contd...

4.27: Total Variance Explained for environmental factors in India	107
4.28: Rotated Component Matrixa for environmental factors in India	108
4.29: Fit Indices for environmental factors in India	109
4.30: Standardized regression weights for environmental factors in India	110
4.31: KMO and Bartlett's Test for project characteristic factors in Iran	110
4.32: Total Variance Explained for project characteristic factors in Iran	111
4.33: Component Matrix for project characteristic factors in Iran	112
4.34: Indices for project characteristic factors in Iran	112
4.35: Standardized regression weights for project characteristic factors in Iran	113
4.36: KMO and Bartlett's Test for project characteristic factors in India	113
4.37: Total Variance Explained for project characteristic factors in India	113
4.38: Component Matrix for project characteristic factors in India	114
4.39: Fit Indices for project characteristic factors in India	115
4.40: Standardized regression weights for project characteristic factors in India	115
4.41: Transactional versus Transformational leaders	117
5.1: KMO and Bartlett's Test for indicators in Iran	128
5.2: Total Variance Explained for performance indicators in Iran	129
5.3: Rotated Component Matrix for performance indicators in Iran	130
5.4: Fit Indices for performance indicators in Iran	132
5.5: Standardized regression weights for performance indicators in Iran	134
5.6: KMO and Bartlett's Test for indicators in India	134
5.7: Total Variance Explained for performance indicators in India	135
5.8: Rotated Component Matrix for performance indicators in India	136
5.9: Fit Indices for performance indicators in India	138
5.10: Standardized regression weights for performance indicators in India	140
5.11: Mean of Cost Performance of Metro Construction Projects in India	141
5.12: Mean of Time Performance of Metro Construction Projects in India	141
5.13: Mean of Satisfaction Performance of Metro Construction Projects in India	141
5.14: Mean of Dispute Avoidance of Metro Construction Projects in India	141
5.15: Mean of Safety Performance of Metro Construction Projects in India	141
5.16: Mean of Cost Performance of Metro Construction Projects in Iran	142
5.17: Mean of Time Performance of Metro Construction Projects in Iran	142
5.18: Mean of Satisfaction Performance of Metro Construction Projects in Iran	142
5.19: Mean of Dispute Avoidance of Metro Construction Projects in Iran	142
5.20: Mean of Safety Performance of Metro Construction Projects in Iran	142

List of Tables Contd...

5.21: Structural self-interaction matrix (SSIM), Iran	143
5.22: Initial reachability matrix	144
5.23: Final reachability matrix	144
5.24: Identification of levels	145
5.25: Structural self-interaction matrix (SSIM), India	146
5.26: Initial reachability matrix, India	146
5.27: Final reachability matrix, India	147
5.28: Identification of levels, India	147
5.29: Fit Indices for SEM in Iran	148
5.30: Regression weights for performance indicators in Iran	150
5.31: Fit Indices for SEM in India	151
5.32: Regression weights for performance and group factors in India	152
6.1: Structural self-interaction matrix (SSIM) for enablers in Iran	157
6.2: Initial reachability matrix for enablers in Iran	158
6.3: Final reachability matrix for enablers in Iran	158
6.4: Identification of levels for enablers in Iran	159
6.5: Mean of Age of project managers in Iran	161
6.6: Frequency of ages in the sample in Iran	161
6.7: Structural self-interaction matrix (SSIM) for enablers in India	164
6.8: Initial reachability matrix for enablers in India	164
6.9: Final reachability matrix for enablers in India	165
6.10: Identification of levels for enablers in India	165
6.11: Mean of Age of project managers in India	168
6.12: Frequency of ages in the sample in India	168
6.13: Structural self-interaction matrix (SSIM) for Inhibitors in Iran	171
6.14: initial reachability matrix for Inhibitors in Iran	171
6.15: Final reachability matrix for Inhibitors in Iran	172
6.16: Identification of levels for Inhibitors in Iran	172
6.17: Structural self-interaction matrix (SSIM) for Inhibitors in India	176
6.18: Initial reachability matrix for Inhibitors in India	177
6.19: Final reachability matrix for Inhibitors in India	177
6.20: Identification of levels for Inhibitors in India	178
7.1: Weighting methods and composite indicators	186
7.2: AHP pairwise comparison scale	188
7.3: Classifies Group factors' ranking within three areas	192

List of Tables Contd...

7.4: Classifies Group factors' ranking within two areas	193
7.5: Classifies Group factors' ranking within three areas	194
7.6: Classifies Group factors' ranking within two areas	195
7.7: Classifies Group factors' ranking within two areas	196
7.8: Classifies Group factors' ranking within three areas	197
7.9: Classifies Group factors' ranking within five areas	200
7.10: Classifies Group factors' ranking within three areas	201
7.11: Classifies Group factors' ranking within three areas	202
7.12: Classifies Group factors' ranking within five areas	203
7.13: Correlations b/w PPI and metro construction performance in Iran	205
7.14: Correlations b/w PPI and metro construction performance in India	205