



Engineering Project Management

THIRD EDITION

Edited by N. J. Smith



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Engineering Project Management

Preface

In many sectors of industry the significance of good project management in delivering projects in accordance with predetermined objectives has been established. Industrialists and engineering institutions have called for the inclusion of a significant proportion of project management in higher-level degrees, something realised by Finniston in his review of the *Future of Engineering* in 1980. Since the publication of the first edition of this book in 1995 a number of significant developments have taken place. A British Standard for Project Management, BS 6079, has been published, and the UK-based Association for Project Management has produced a fundamental guide to processes and practice entitled *Body of Knowledge* and drafted a standard contract for employing project managers. There has also been a marked increase in the teaching and delivery of university programmes and in continuing professional development (CPD) courses for project management.

Many organisations in the engineering, financial, business, process and other sectors are appointing people as project managers, some with a very narrow, brief and precise role, whereas others have a more strategic, managerial and multidisciplinary function. This third edition builds upon the successes of the first two editions in providing a clear picture of the aim of project management based upon best practice and some consideration of its continuing evolution. The improvements to this edition have been driven by the changes to the practice of project management and by the helpful comments made by book reviewers and readers since 1995.

Changes in the management of major projects have resulted in more joint ventures, project partnering, special project vehicles and other forms of collaborative working, which are reflected in the updated and extended text, covering procurement, stakeholders and collaborative provision. The new edition includes new chapters on quality, public-private partnerships and a detailed and authoritative chapter on the PRINCE2™ project management methodology (PRINCE2™ is a Trade Mark of the Office of Government Commerce). The book is not aimed at any particular sector of engineering but relates to the management of any major technical project.

Newly appointed project managers and students of project management at the MEng, MBA and MSc level will find the enhanced text and references beneficial. The book is concerned with the practice and theory of project management, particularly in relation to multidisciplinary engineering projects, large and small, in the UK and overseas.

Acknowledgements

I am particularly grateful to my co-authors and fellow contributors to this book. I am especially indebted to those who have participated in all three editions, namely, Dr Denise Bower, Dr Tony Merna and Mr Ian Vickridge. I am also grateful to the new contributor for this edition, Mr Mark Gannon, and I thank again the contributors to the earlier editions, particularly my colleagues at the University of Leeds.

The editor and the authors would like to express their appreciation to Sally Mortimer for managing the existing text and artwork from the previous editions. I would also like to thank Sally for formatting, checking and revising each of the many draft versions of every chapter. Nevertheless, the responsibility for any errors remains entirely my own.

N. J. Smith

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Nigel is professor of transport infrastructure and project management and the head of school in the School of Civil Engineering at the University of Leeds. After graduating from the University of Birmingham, he spent 17 years in industry mainly working on major transportation infrastructure projects. Since returning to university life, his research interests have included project management, procurement methods and, in particular, privately financed concessions, risk management and the management of maintenance. He has seen a rapid expansion in activity over the last 5 years. From a small base, 'project' management research in the school is now active in all aspects of 'engineering' management. Research funding has been attracted from a range of national and international sources and from collaborating organisation in industry. Recent work includes studies of competitiveness in airport design, PRIME Contracting, public-private partnerships in Europe, value management and light rail transit schemes.

Denise Bower, BEng, PhD, M.ASCE, ILTM

Denise is a professor in project management and the deputy head of the School of Civil Engineering, University of Leeds. Her recent work includes the evaluation of procurement strategies, assessment of corporate strategy, the development of organisational partnering guidelines and the evaluation of the success criteria for a number of partnering arrangements and recommendations of contract strategies for overseas projects. She is also the programme leader of the MSc Engineering Project Management, which attracts international students from a wide range of backgrounds, and is directing doctoral studies in the area of procurement and contracts; her particular area of research interest is in the optimisation of the procurement of contracted services. She is the author and joint author of many books and publications, including *The Management of Procurement*, *Engineering Project Management*, *Dispute Resolution for Infra-Structure Projects* and *Managing Risk in Construction Projects*.

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Anthony Merna, BA, MPhil, PhD, CEng, MICE, MAQA, MAPM

Tony is the senior partner at Oriel Group Practice, a multidisciplinary consulting organisation based in Manchester. He is also a lecturer at the Centre for Research in the Management of Projects at UMIST. He has been actively involved in the management of infrastructure projects and has wide experience of project management and consultancy in both developed and developing countries.

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Institution of Civil Engineers. He has published extensively on a variety of topics related to construction, environmental management and project management.

David Wright, MA, CChemE, ACI Arb

David left Oxford with a degree in jurisprudence and spent 30 years in industry. He gained experience in the automotive industry, the electronic industry, the defence industry and the chemical engineering and process industry. He was commercial manager of Polibur Engineering Ltd. In the mechanical engineering sector, he was the European legal manager to the Mather & Platt Group. He is now a consultant on matters of contract and commercial law.

List of Abbreviations

ABS	Assembly breakdown structure
ACWP	Actual cost of work performed
ADB	Asian Development Bank
ADR	Alternative dispute resolution
AfDB	African Development Bank
APM	Association for Project Management
BAC	Budget (baseline) at completion
BCWP	Budgeted cost of work performed
BCWS	Budgeted cost of work scheduled
BOD	Build, operate, deliver
BOL	Build, operate, lease
BOO	Build, own, operate
BOOST	Build, own, operate, subsidise, transfer
BOOT	Build, own, operate, transfer
BoQ	Bill of quantities
BOT	Build, operate, transfer
BP	Basis points
BPR	Business process re-engineering
BRT	Build, rent, transfer
BTO	Build, transfer, operate
CBA	Cost-benefit analysis
CCTA	Central Computing and Telecommunication Agency
CII	Construction Industry Institute (Texas)
CPD	Continuing professional development
CPI	Cost performance index
CRINE	Cost reduction in the new era
CS	Controlling stage
CV	Cost variance
DBOM	Design, build, operate, maintain
DBOT	Design, build, operate, transfer
DCMF	Design, construct, manage and finance
DEO	Defence Estates Organisation
DETR	Department of the Environment, Transport and the Regions
DFA	Design for assembly
DfID	Department of International Development
DFM	Design for manufacturing

DP	Directing a project
DSM	Dependency structure matrix
DTI	Department of Trade and Industry
EBRD	European Bank for Reconstruction and Development
ECC	Engineering and construction contract
ECGD	Export Credit Guarantee Department
ECI	European Construction Institute
EIA	Environmental impact assessment
EIB	European Investment Bank
EIS	Environmental impact statement
EMS	Environmental management system
EPC	Engineer, procure, construct
EPIC	Engineer, procure, install, commission
EQI	Environmental quality index
ERP	Enterprise resource planning
EU	European Union
EVA	Earned value analysis
FAST	Functional Analysis Systems Technique
FBOOT	Finance–build–own–operate–transfer
FDA	Food and Drug Administration
FIDIC	Fédération Internationale des Ingénieurs Conseils (Lausanne)
GDR	Global depository receipt
GUI	Graphical user interface
HMPS	Her Majesty's Prison Service
HSE	Health and Safety Executive
ICT	Information and communication technology
IFC	International Finance Corporation
IP	Initiating project
IPT	Integrated project team
IRR	Interest rate risk
IT	Information Technology
LIBOR	London Interbank Offered Rate
MARR	Minimum acceptable rate of return
MBO	Management buy-out
MCA	Medicines Control Agency
MoD	Ministry of Defence
MPD	Managing project delivery
NEC3	New Engineering Contract
NEPA	National Environmental Protection Agency
NGO	Non-governmental organisation
NIF	Note issuance facility
NPV	Net present value
OBS	Organisational breakdown structure
OECD	Organisation for Economic Cooperation and Development
OGC	Office for Government and Commerce

PBP	Product-based planning
PBS	Product breakdown structure
PC	Procure, construct
PCM	Project cycle management
PEP	Project execution plan
PERT	Programme Evaluation and Review Technique
PFD	Product flow diagram
PFI	Private finance initiative
PIC	Procure, install, commission
PID	Project initiation document
PIM	Personal information manager
PL	Planning
PMI	Project Management Institute
PPP	Public-private partnership
PRINCE2™	PRoject IN Controlled Environments 2
PROMPT	Project Resource Organisation Management Planning Technique
PSBR	Public sector borrowing requirement
QA	Quality assurance
QC	Quality control
QFD	Quality function deployment
QM	Quality management
QMS	Quality management system
QP	Quality planning
QST	Quality system team
RC	Relational contracting
RE	Reliability engineering
RUF	Revolving underwriting facility
SB	Stage boundaries
SCA	Structured concession agreement
SCM	Supply-chain management
SPI	Schedule performance index
SPV	Special project vehicle
SU	Starting up a project
SV	Schedule variance
TCM	Travel-cost method
TCN	Third country nationals
TQM	Total quality management
TUPE	Transfer of undertaking from previous employer
USGF	US Gulf Factor
VA	Value analysis
VE	Value engineering

VM	Value management
VP	Value planning
VR	Value reviewing
WBS	Work breakdown structure
WMG	Warwick Manufacturing Group
WTA	Willingness to accept
WTP	Willingness to pay

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