

CONTENTS

Acknowledgements xi

Introduction 1

01 The role of the warehouse 7

Introduction 7

Types of warehouse operation 13

Why do we hold stock? 19

Warehouse location 27

Number of warehouses 34

Supply chain trends affecting warehouses 36

The growth of e-fulfilment and its effect on the warehouse 37

Specialized warehousing 40

Summary and conclusion 57

02 Role of the warehouse manager 58

Introduction 58

Warehouse trade-offs 60

The warehouse manager's challenges 61

Lean warehousing 69

People management 76

People challenges 77

Attracting and retaining warehouse employees 81

An ageing and constantly changing workforce 82

Operating hours 83

Training 86

Warehouse audit 87

Quality systems 87

Summary and conclusion 88

03 Warehouse processes: receiving and put-away 89

Introduction 89

Receiving 91

Pre-receipt 91

- In-handling 99
- Preparation 99
- Offloading 102
- Cross docking 111
- Recording 113
- Quality control 113
- Put-away 114
- Summary and conclusion 115

04 Warehouse processes: pick preparation 117

- Introduction 117
- Preparation 119
- Warehouse pick area layout 133
- Summary and conclusion 138

05 Goods-to-person and person-to-goods picking 140

- Introduction 140
- Picker to goods 143
- Goods to picker 150
- Types of semi-automated picking 152
- Robotics 164
- Automation enablers 175
- Summary and conclusion 177

06 Order-picking methods 182

- Introduction 182
- Paper pick lists 183
- Pick by label 183
- Pick by voice 184
- Barcode scanning 192
- Radio frequency identification (RFID) 198
- Pick by light/pick to light 200
- Put to light 202
- Vision pick 203
- Comparisons 207
- Cost of errors 211
- Deciding on type of picking system and equipment 212
- Summary and conclusion 214

07 Warehouse processes from replenishment to despatch and beyond 215

Introduction 215

Replenishment 215

Value-adding services 217

Indirect activities 219

Stock management 219

Stock or inventory counting 221

Cycle counting or perpetual inventory counts 222

The count itself 223

Security 226

Returns processing 227

Despatch 232

Documentation 240

Role of the driver 241

Summary and conclusion 241

08 Information systems in the warehouse 242

Introduction 242

Why does a company need a WMS? 243

Choosing a WMS 245

The process 246

Selecting the right WMS 246

What to look for in a system 250

Selecting a partner 252

Decision table/decision matrix analysis (DMA) 253

Before the final decision 255

Implementation 255

Software as a service 256

Cloud computing 256

Machine learning in the warehouse by Harry Watts SEC 257

Data security 259

Summary and conclusion 260

09 Warehouse layout 261

Introduction 261

Data collection and analysis 267

Space calculations 270

	Aisle width	277
	Other space	279
	Warehouse layout examples	280
	Finding additional space	282
	Summary and conclusion	285
10	Storage and handling equipment	287
	Introduction	287
	Storage equipment	287
	Storage options	289
	Shuttle technology with a difference	302
	Very high bay warehouses	302
	Other storage media	307
	Warehouse handling equipment	313
	Vertical and horizontal movement	318
	Specialized equipment	333
	Automated storage and retrieval systems (AS/RS)	335
	Recent technical advances	337
	Summary and conclusion	339
11	Resourcing a warehouse	340
	Introduction	340
	Processing activities	341
	Other factors	368
	Fulfilment centre resource planning	370
	Modelling automation	371
	Summary and conclusion	372
12	Warehouse costs	373
	Introduction	373
	Types of costs	374
	Return on investment (ROI)	376
	Traditional versus activity-based costing systems	378
	Charging for shared-user warehouse services	385
	Logistics charging methods	388
	Hybrid	392
	Summary and conclusion	393

13	Performance measurement and management	394
	Introduction	394
	Why do we need to measure?	395
	What should we be measuring?	396
	How to choose the right performance measures	401
	Traditional productivity measures	403
	New performance metrics	407
	Hard and soft measures	409
	Integrated performance models	410
	Benchmarking	412
	Balanced scorecard	415
	Summary and conclusion	419
14	Health and safety	420
	Introduction	420
	Risk assessments	423
	Layout and design	430
	Fire safety	432
	Slips and trips	434
	Manual handling	435
	Working at height	435
	Vehicles	436
	Forklift trucks	438
	Warehouse equipment legislation	439
	First aid	440
	Insuring against liability	441
	Health	441
	Summary and conclusion	444
15	The warehouse and the environment	446
	Introduction	446
	Legislation and other pressures	450
	Warehouse energy usage	450
	Energy production	454
	The environment and waste	455
	Packaging	456
	Pallets	457
	Stretchwrap	458

Cartons	458
Labelling	459
Product waste	459
Waste disposal	459
Hazardous waste	459
Forklift trucks	459
Equipment disposal	460
Summary and conclusion	460

16 The warehouse of the future 462

Introduction	462
Context	464
Predictions for the future	468
Views of the future: the warehouse	470
Other advances	475
Summary and conclusion	477

Appendix 1 Global warehouse costs 478

Appendix 2 Warehouse audit checklists 480

Further information 496

Bibliography 497

*Websites of companies that have contributed to this book and other
useful websites 505*

Glossary 507

Index 511