

TRANSPORTATION

A GLOBAL SUPPLY CHAIN PERSPECTIVE



NOVACK/GIBSON/SUZUKI/COYLE

TRANSPORTATION

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Robert A. Novack, Brian J. Gibson, Yoshinori Suzuki and John J. Coyle

Senior Vice President, Higher Ed Product, Content, and Market Development:
Mike Schenk

Product Director: To provide

Product Manager: Aaron Arnsperger

Content Developer: Tara Slagle, MPS

Product Assistant: Renee Schnee

Sr. Marketing Manager: Nate Anderson

Manufacturing Planner: Ron Montgomery

Intellectual Property

Analyst: Terina Bradley

Project Manager: Nick Barrow

Project Management and Composition:
SPi Global

Senior Art Director: Michelle Kunkler

Cover Designer: Laura Brown

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Brief Contents

Preface	xv
About the Authors	xviii

Part I

Chapter 1	Global Supply Chains: The Role and Importance of Transportation	3
Chapter 2	Transportation and the Economy	32
Chapter 3	Transportation Technology and Systems	55
Chapter 4	Costing and Pricing for Transportation	83
<i>Suggested Readings for Part I</i>		151

Part II

Chapter 5	Motor Carriers	154
Chapter 6	Railroads	199
Chapter 7	Airlines	229
Chapter 8	Water Carriers and Pipelines	253
<i>Suggested Readings for Part II</i>		284

Part III

Chapter 9	Third Party Logistics	287
Chapter 10	Transportation Risk Management	331
Chapter 11	Global Transportation Management	357
Chapter 12	Governmental Roles in Transportation	397
Chapter 13	Issues and Challenges for Global Supply Chains	433
<i>Suggested Readings for Part III</i>		459

Glossary	461
Name Index	473
Subject Index	476

Appendix A Selected Transportation Publications A-1 (available on book companion website cengagebrain.com)

Appendix B Transportation-Related Associations B-1 (available on book companion website cengagebrain.com)

Contents

Preface xv

About the Authors xviii

Part I

Chapter 1	Global Supply Chains: The Role and Importance of Transportation	3
	TRANSPORTATION PROFILE: Critical Role of Transportation in Global Economy	4
	Introduction	5
	Global Supply Chain Flows	5
	The Economic Basis and Logic of Improved Global Trade	10
	<i>Absolute and Comparative Advantage</i>	11
	Contributing Factors for Global Flows and Trade	12
	<i>Population Size and Distribution</i>	12
	Urbanization	16
	Land and Resources	16
	Technology and Information	17
	Globalization	18
	Supply Chain Concept	19
	<i>Development of the Concept</i>	19
	GLOBAL PROFILE: EU: Be a Player, Not a Follower	19
	ON THE LINE: Port Tracker Calls for Strong Annual Growth in First Half of 2017	24
	<i>Summary</i>	26
	<i>Study Questions</i>	27
	<i>Case 1-1: Clearfield Cheese Company Case: A Sequel</i>	28
	<i>Case 1-2: TEA Logistics Services, Inc.</i>	30
	<i>Notes</i>	31
Chapter 2	Transportation and the Economy	32
	Introduction	33
	Up and Down with the Big Muddy	33
	Historical Significance	34
	Economics of Transportation	35
	<i>Demand for Transportation</i>	35
	<i>Passenger Demand</i>	36
	Transport Measurement Units	37
	ON THE LINE: Cass Freight Index Paints Optimistic Future	37

- Demand Elasticity* 39
- Freight Transportation Demand* 40
- Service Components of Freight Demand* 42
- TRANSPORTATION PROFILE: Uber Freight Makes Official Entrance into Trucking Market** 44
 - Value of Goods* 45
 - Gross Domestic Product (GDP)* 48
- Environmental Significance 49
 - The Environment* 49
 - Safety* 50
- Social Significance 50
- Political Significance 51
 - Summary* 51
 - Study Questions* 52
 - Notes* 52
 - Case 2-1: Highways Galore* 53
 - Case 2-2: Transportation and Economic Activity* 54
- Chapter 3** Transportation Technology and Systems 55
 - TRANSPORTATION PROFILE: Cold Chain Pharma Logistics Is Heating Up** 56
 - Introduction 57
 - Information Requirements 58
 - Quality Standards* 58
 - Multidirectional Flow* 59
 - ON THE LINE: Maersk Makes Bold Bid at Differentiation by Teaming with CRM Giant** 60
 - Decision Support* 61
 - Transportation Software 61
 - Transportation Management Systems* 62
 - Additional Applications* 66
 - Transportation Software Selection and Implementation 66
 - Needs Assessment* 66
 - Software Selection* 67
 - Implementation Issues* 68
 - Transportation Equipment Technology 69
 - Sustainability Initiatives* 70
 - TRANSPORTATION TECHNOLOGY: The Electric Truck Race** 71
 - Safety Efforts* 72
 - Cargo Security Innovations* 72
 - Emerging Technologies 73
 - Autonomous Transportation* 74
 - Blockchain for Freight* 75
 - GLOBAL PERSPECTIVES: Shipping Without Sailors** 75
 - Next Generation TMS* 76
 - Summary* 77

	<i>Study Questions</i>	78
	<i>Notes</i>	78
	<i>Case 3-1: myloT Inc.</i>	81
	<i>Case 3-2: Vital-E Nutrition</i>	82
Chapter 4	Costing and Pricing for Transportation	83
	TRANSPORTATION PROFILE: Disintermediation to Hit Freight Brokerage	84
	Introduction	85
	Market Considerations	86
	<i>Market Structure Models</i>	86
	<i>Theory of Contestable Markets</i>	87
	<i>Relevant Market Areas</i>	88
	Cost-of-Service Pricing	89
	Value-of-Service Pricing	93
	Rate Making in Practice	99
	<i>General Rates</i>	99
	<i>Rate Systems Under Deregulation</i>	105
	Special Rates	106
	<i>Character-of-Shipment Rates</i>	107
	ON THE LINE: Werner CEO: Truckload Rates Getting Back to “Equilibrium”	
	After Slump	108
	<i>Area, Location, or Route Rates</i>	109
	<i>Time/Service Rate Structures</i>	110
	<i>Other Rate Structures</i>	111
	TRANSPORTATION TECHNOLOGY: Freight Payment Versus Freight	
	Settlement	113
	Pricing in Transportation Management	114
	<i>Factors Affecting Pricing Decisions</i>	114
	<i>Major Pricing Decisions</i>	115
	<i>Establishing the Pricing Objective</i>	116
	<i>Estimating Demand</i>	117
	<i>Estimating Costs</i>	118
	<i>Price Levels and Price Adjustments</i>	119
	<i>Most Common Mistakes in Pricing</i>	121
	Summary	122
	Study Questions	122
	Notes	122
	<i>Case 4-1: Mid-West Trucking</i>	124
	<i>Case 4-2: Hardee Transportation</i>	125
	Appendix 4A: Cost Concepts	127
	Accounting Cost	127
	Economic Cost	127
	Social Cost	128
	Analysis of Cost Structures	128
	Rail Cost Structure	133
	Motor Carrier Cost Structure	133

Other Carriers' Cost Structures	134
Notes	134
Appendix 4B: LTL and TL Costing Models	136
Operational Activities	136
Cost/Service Elements	136
TL Costing	136
Equipment Cost Data	137
LTL Costing	140
Equipment Cost Data	140
Conclusion	145
Appendix 4C: Yield Management Pricing	146
Seat Allocation	146
Overbooking	148
Suggested Readings for Part I	151

Part II

Chapter 5 Motor Carriers	154
TRANSPORTATION PROFILE: Increasing Complexity in Parcel	155
Introduction	156
Industry Overview	156
Significance	156
Types of Carriers	156
Number of Carriers	159
Market Structure	161
Competition	161
Operating and Service Characteristics	162
General Service Characteristics	162
Equipment	163
Types of Vehicles	164
Terminals	165
Terminal Management Decisions	169
Fuel Management	170
Cost Structure	178
Fixed Versus Variable Cost Components	178
ON THE LINE: The Never-Ending Truck Driver Shortage	179
Economies of Scale	181
Private Trucking	184
What Is Private Trucking?	184
Current Issues	186
Safety	186
Technology	187
Driver Turnover	188
Green and Sustainable Operations	189

	TRANSPORTATION TECHNOLOGY: Truckers Prepare for Era of Driverless Trucks—Coming Sooner Rather than Later	190
	<i>Financial Stability</i>	191
	<i>Summary</i>	191
	<i>Study Questions</i>	193
	<i>Notes</i>	193
	<i>Case 5-1: Hardee Transportation</i>	196
	<i>Case 5-2: Cyclone Transportation</i>	197
Chapter 6	Railroads	199
	TRANSPORTATION PROFILE: Capturing Inventory In-Transit on Rail	200
	Introduction	201
	Industry Overview	202
	<i>Number of Carriers</i>	202
	<i>Competition</i>	203
	GLOBAL PERSPECTIVES: Florida East Coast Railway to Be Acquired by Grupo Mexico	205
	Operating and Service Characteristics	206
	<i>General Service Characteristics</i>	206
	<i>Constraints</i>	208
	<i>Strengths</i>	208
	<i>Equipment</i>	209
	<i>Service Innovations</i>	210
	ON THE LINE: Schneider and CSX Ink New Rail Service Contract	213
	Cost Structure	214
	<i>Fixed Costs</i>	214
	<i>Semivariable Costs</i>	215
	<i>Variable Costs</i>	215
	<i>Economies of Scale</i>	216
	Financial Plight	217
	<i>Legislation Reform</i>	218
	<i>Improved Service to Customers</i>	219
	Current Issues	219
	<i>Alcohol and Drug Abuse</i>	219
	<i>Energy</i>	220
	<i>Technology</i>	221
	TRANSPORTATION TECHNOLOGY: GAO Report Calls on Congress to Extend Positive Train Control Deadline	221
	<i>Future Role of Smaller Railroads</i>	222
	<i>Customer Service</i>	223
	<i>Drayage for Intermodal Service</i>	223
	<i>Summary</i>	224
	<i>Study Questions</i>	224
	<i>Notes</i>	225
	<i>Case 6-1: CBN Railway Company</i>	227
	<i>Case 6-2: Rail Versus Pipeline Investment</i>	228

Chapter 7	Airlines	229
	TRANSPORTATION PROFILE: Air: Ending on a High Note	230
	Introduction	230
	Industry Overview and Significance	231
	Types of Carriers	231
	<i>Private Carriers</i>	231
	<i>For-Hire Carriers</i>	231
	Market Structure	232
	<i>Number of Carriers</i>	232
	Competition	233
	<i>Intermodal</i>	233
	<i>Intramodal</i>	234
	<i>Service Competition</i>	234
	<i>Cargo Competition</i>	234
	Operating and Service Characteristics	235
	<i>General</i>	235
	GLOBAL PERSPECTIVES: Air Cargo Link to Trade Growth	235
	<i>Speed of Service</i>	236
	<i>Length of Haul and Capacity</i>	236
	<i>Accessibility and Dependability</i>	238
	Equipment	238
	<i>Types of Vehicles</i>	238
	<i>Terminals</i>	239
	ON THE LINE: USPS and FedEx Express Re-up on Air Transportation Partnership	239
	Cost Structure	240
	<i>Fixed- Versus Variable-Cost Components</i>	240
	<i>Fuel</i>	241
	<i>Labor</i>	242
	<i>Equipment</i>	242
	<i>Economies of Scale/Economies of Density</i>	243
	Rates	245
	<i>Pricing</i>	245
	<i>Operating Efficiency</i>	245
	Current Issues	246
	<i>Safety</i>	246
	<i>Security</i>	247
	<i>Technology</i>	248
	<i>Summary</i>	248
	<i>Study Questions</i>	249
	<i>Notes</i>	250
	<i>Case 7-1: NextGen Technology</i>	251
	<i>Case 7-2: Airline Consolidations</i>	252

Chapter 8	Water Carriers and Pipelines	253
	TRANSPORTATION PROFILE: Inland Waterways Realize Volume Increase	254
	Introduction	254
	Brief History of Water Transportation	254
	Water Transport Industry Overview	255
	<i>Significance of Water Transport</i>	255
	<i>Types of Carriers</i>	257
	TRANSPORTATION TECHNOLOGY: Federal Maritime Commission Hosts Blockchain Discussion	258
	<i>Number and Categories of Carriers</i>	259
	<i>Competition</i>	259
	<i>Operating and Service Characteristics</i>	260
	<i>Equipment</i>	262
	<i>Cost Structure</i>	266
	<i>Current Issues</i>	267
	Brief History of Pipelines	268
	Pipeline Industry Overview	269
	<i>Significance of Pipelines</i>	269
	<i>Types of Carriers</i>	270
	<i>Ownership</i>	270
	<i>Number of Carriers</i>	271
	<i>Operating and Service Characteristics</i>	272
	<i>Relative Advantages</i>	272
	<i>Relative Disadvantages</i>	273
	<i>Competition</i>	273
	<i>Equipment</i>	274
	<i>Commodity Movement</i>	275
	<i>Cost Structure</i>	276
	ON THE LINE: OPEC's Production Cuts Are Greatly Overrated	277
	<i>Summary</i>	278
	<i>Study Questions</i>	279
	<i>Case 8-1: Great Lakes Carriers: A Sequel</i>	281
	<i>Case 8-2: The Keystone Pipeline</i>	283
	<i>Suggested Readings for Part II</i>	284

Part III

Chapter 9	Third Party Logistics	287
	TRANSPORTATION PROFILE: Key Criteria for Evaluating Potential 3PL Providers	288
	Introduction	288
	Industry Overview	289
	<i>Types of 3PL Providers</i>	290
	ON THE LINE: Uber Freight Makes Official Entrance into Trucking Market	294
	<i>3PL Services and Integration</i>	295

	GLOBAL PERSPECTIVES: Global 3PL Management: Factors to Keep at Top of Mind	299
	3PL User Overview	300
	<i>Reasons for Outsourcing</i>	300
	<i>Primary Activities Outsourced</i>	302
	<i>Results Achieved</i>	303
	Establishing and Managing 3PL Relationships	303
	Strategic Needs of 3PL Users	307
	TRANSPORTATION TECHNOLOGY: The Payoffs of 3PL Investment in IT Capabilities	309
	3PL Versus Private Carrier	311
	<i>Operating Cost</i>	311
	<i>Summary</i>	317
	<i>Study Questions</i>	318
	<i>Notes</i>	319
	<i>Case 9-1: Closet Concepts Ltd.</i>	321
	<i>Case 9-2: C.H. Robinson Worldwide, Inc.</i>	323
	Appendix 9A: Third Party Logistics and TL Auction	326
	<i>TL Auction: The Traditional Procedure</i>	326
	<i>Limitation with Traditional Procedure</i>	327
	<i>A New Recent Approach</i>	328
	<i>Future Direction</i>	329
Chapter 10	Transportation Risk Management	331
	TRANSPORTATION PROFILE: The New Transportation Risk	332
	Introduction	332
	Risk Concepts	333
	Transportation Risks	334
	<i>Product Loss</i>	335
	<i>Product Damage</i>	335
	<i>Product Contamination</i>	336
	<i>Delivery Delay</i>	336
	<i>Supply Chain Interruption</i>	337
	<i>Security Breach</i>	337
	Transportation Risk Management Process	338
	<i>Step 1—Risk Identification</i>	339
	GLOBAL PERSPECTIVES: Transportation Risk—Who or What Is to Blame?	340
	<i>Step 2—Risk Assessment</i>	341
	<i>Step 3—Risk Management Strategy Development</i>	342
	ON THE LINE: Hedging Those Transportation Bets	344
	TRANSPORTATION TECHNOLOGY: Those Things Can Reduce Your Risk	347
	<i>Step 4—Risk Review and Monitoring</i>	349
	<i>Summary</i>	349
	<i>Study Questions</i>	350
	<i>Notes</i>	351

Case 10-1: Young Again Pharmaceuticals 353
Case 10-2: RIoT Athletic 355

Chapter 11	Global Transportation Management	357
	TRANSPORTATION PROFILE: F ⁴ —Fast Flowing Fast-Fashion	358
	Introduction	358
	<i>Transaction Processes</i>	359
	<i>Terms of Trade</i>	359
	<i>Cargo Insurance</i>	362
	ON THE LINE: Cargo Theft—A Global Epidemic	364
	<i>Terms of Payment</i>	365
	<i>Distribution Processes</i>	366
	<i>Mode Selection</i>	366
	<i>International Air</i>	371
	<i>Intermodal Transportation</i>	373
	GLOBAL PERSPECTIVES: Are Bigger Ships Better?	377
	<i>Carrier Selection</i>	377
	<i>Route Selection</i>	378
	<i>Delivery Execution</i>	379
	<i>Communication Processes</i>	382
	TRANSPORTATION TECHNOLOGY: Paperless Global Transportation—Slow but Steady Progress	387
	<i>Summary</i>	391
	<i>Study Questions</i>	392
	<i>Notes</i>	392
	<i>Case 11-1: 3D Printers for the Masses</i>	395
	<i>Case 11-2: As the Blade Turns</i>	396
Chapter 12	Governmental Roles in Transportation	397
	TRANSPORTATION PROFILE: Late Push to Extend ELD Implementation Date Nixed by House Vote	398
	Introduction	399
	Transportation Policy	400
	<i>Why Do We Need a Transportation Policy?</i>	401
	<i>Who Establishes Policy?</i>	402
	ON THE LINE: The Fight Over Five Feet	405
	Transportation Regulation	406
	<i>Basis of Regulation</i>	407
	<i>Responsibility for Regulation</i>	407
	<i>Focus of Regulation</i>	410
	GLOBAL PERSPECTIVES: State of Ocean Cargo: Carriers Cope with Regulatory Restrictions	413
	<i>A Concise Chronology of Transportation Regulation</i>	418
	Transportation Planning, Promotion, and Programs	419
	<i>Transportation Planning and the Public Sector</i>	420
	TRANSPORTATION TECHNOLOGY: A Unique and Clean Approach to Shore Power	420

An Approach to Public Project Planning Analysis 421
Modal Promotion Activities 423
Paying for Transportation Programs 427
Summary 428
Study Questions 429
Notes 430
Case 12-1: Who Pays the Price? 431
Case 12-2: Federal Highway Infrastructure Funding 432

Chapter 13 Issues and Challenges for Global Supply Chains 433
TRANSPORTATION PROFILE: It's "Beyond Time" to Modernize U.S. Infrastructure, U.S. Chamber of Commerce Urges 434
Introduction 435
Transportation Infrastructure 436
Highway Traffic and Infrastructure 437
Railroad Traffic and Infrastructure 438
Waterway Traffic and Infrastructure 439
Talent Management 441
Sustainability: Going Green with Transportation 444
ON THE LINE: Wal-mart's "Project Gigaton" Focuses on Major Supply Chain Greenhouse Gas Emissions Reduction Effort 448
Fuel Cost and Consumption 448
Motor Carriers 449
Air Carriers 450
Water Carriers 450
Rail Carriers 451
Pipeline Carriers 451
Carriers' Responses 451
Summary 453
Study Questions 454
Notes 454
Case 13-1: Sustainability and Night Delivery 456
Case 13-2: Bald Eagle Valley Trucking 458
Suggested Readings for Part III 459

Glossary 461
Name Index 473
Subject Index 476

Appendix A Selected Transportation Publications **A-1** (available on book companion website cengagebrain.com)

Appendix B Transportation-Related Associations **B-1** (available on book companion website cengagebrain.com)

Preface

Transportation is the critical link in successful supply chains. It is a key facilitator of global economic development, quality of life improvement, and enterprise success. Effective transportation processes ensure the rapid flow of essential goods across complex global supply chains. Efficient transportation operations keep delivery costs in check to ensure that products are affordable in multiple markets.

Transportation professionals are tasked with balancing these effectiveness and efficiency goals. They must also manage complex transportation networks and minimize disruptions of cross-border product flows to meet the ever-increasing service demands of the 21st century customer. While these are not easy tasks, high-quality work by dedicated transportation professionals is essential for global trade to thrive.

In this book, *Transportation: A Global Supply Chain Perspective*, Ninth Edition, we continue to focus on the widespread impact of commercial transportation on worldwide commerce. We believe that the contents of this book will help future transportation professionals prepare for successful careers in this dynamic field. Our text follows the format of the previous edition with three sections and thirteen chapters. Substantive additions and revisions have been made to enhance the content and organization. In particular, the critical role of technology in global transportation receives special attention in this edition.

Part I provides the foundation for the overall text. Chapter 1 explores the nature, importance, and critical issues in the global economy, which are important to understand for the current and future transportation systems. Chapter 2 provides the economic foundation and rationale for the role of transportation as well as its political and social importance. Chapter 3 highlights the expanding role of technology in transportation, addressing both software and equipment innovations that drive greater service and lower costs. Chapter 4 offers a discussion of transportation costing and pricing in a market-based economy.

Part II provides an overview of the major transportation alternatives available to individual and organizational users. Chapters 5 through 8 discuss and examine the key features and issues of the five basic modes of transportation, namely, motor (5), rail (6), airline (7), water and pipeline (8). Each of the basic modes offers inherent advantages for shippers of particular commodities or locations that need to be appreciated and understood to gain the economic benefits they offer. The dynamic market environment that exists in many economies demands continuous improvement of modal capabilities if they are to remain relevant.

The chapters in Part III cover a variety of important issues related to the successful management of transportation flows. Each of the five chapters in this section have been updated and revised to further improve their value to the readers. Chapter 9 supplements the information provided in Part II with a detailed discussion of logistics service providers that support the transportation industry. These organizations improve the efficiency, effectiveness, and execution of global supply chain flows. Chapter 10 discusses the topic of risk management, a key concern for many organizations because of the increasing threat of supply chain disruptions in the global economy. Strategies, methods, and outcomes for risk management are explored as well as overall security enhancement. Chapter 11 provides an in-depth discussion of the planning and execution of global transportation with emphasis on trade facilitation, product flows, and information sharing. Chapter 12



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covers the all-important role of government policy, regulation, and promotion in fostering a strong transportation network. Finally, Chapter 13 explores some of the major challenges for transportation in the 21st century, namely, infrastructure funding needs, talent management gaps, environmental sustainability, and fuel management. Each issue threatens to disrupt transportation flows, reduce competitiveness, and increase costs if not managed proactively.

Overall, we are convinced that transportation is a critical engine for business growth and societal advancement, but is often taken for granted until a crisis arises. As stated previously, it may be the most important industry for all economies regardless of their stage of development. Such recognition needs to be accorded to transportation in the future.

Features

1. Learning objectives in the beginning of each chapter provide students with an overall perspective of chapter material and serve to establish a baseline for a working knowledge of the topics that follow.
2. Transportation Profile boxes are the opening vignettes at the beginning of each chapter that introduce students to the chapter's topics through familiar, real-world examples.
3. On the Line features are applied, concrete examples that provide students with hands-on managerial experience of the chapter topics.
4. Transportation Technology boxes help students relate technological developments to transportation management concepts.
5. Global Perspectives boxes highlight the activities and importance of transportation outside of the United States.
6. End-of-chapter Summaries and Study Questions reinforce material presented in each chapter.
7. Short cases at the end of each chapter build on what students have learned. Questions that follow the cases sharpen critical thinking skills.

Ancillaries

1. The *Instructor's Manual* includes chapter outlines, answers to end-of-chapter study questions, commentary on end-of-chapter short cases, and teaching tips.
2. A convenient *Test Bank* offers a variety of multiple-choice, short-answer, and essay questions for each chapter.
3. *PowerPoint slides* cover the main chapter topics and contain figures from the main text.
4. The book companion site (www.cengagebrain.com) provides additional resources for students and instructors. Appendix A, Selected Transportation Publications, and Appendix B, Transportation-Related Associations, can be found on the companion site. The Instructor's Manual and PowerPoint files are downloadable from the site for instructors.

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About the Authors

Robert A. Novack is currently an Associate Professor of Supply Chain Management and Associate Director in the Center for Supply Chain Research at Penn State. Dr. Novack worked in operations management and planning for the Yellow Freight Corporation and in planning and operations for the Drackett Company. He received his bachelor's and MBA degrees from Penn State and a PhD from the University of Tennessee in Knoxville. Dr. Novack has numerous articles published in the *Journal of Business Logistics*, the *Transportation Journal*, and the *International Journal of Physical Distribution and Logistics Management*. He is also the coauthor of three textbooks: *Creating Logistics Value: Themes for the Future*, *Supply Chain Management: A Logistics Perspective* (8e), and *Transportation*. He is on the editorial review board for the *Journal of Business Logistics* and is an area editor for the *Journal of Supply Chain Management*. Dr. Novack is very active in the Council for Supply Chain Management Professionals, having served as overall program chair for the annual conference, as a track chair, and as a session speaker. In addition, he has served on numerous committees with this organization. Dr. Novack holds the CTL designation from the American Society of Transportation and Logistics. His current research interest is on the development and use of metrics in managing supply chains. In 2009, he received the Atherton Teaching Award from Penn State, the highest award given for teaching at that university.

Brian J. Gibson is the Wilson Family Professor of Supply Chain Management and Executive Director of the Center for Supply Chain Innovation at Auburn University. Previously, he served on the faculty of Georgia Southern University and as director of the Southern Center for Logistics and Intermodal Transportation. Dr. Gibson also served as a logistics manager for two major retailers. He is an accomplished faculty member who has received multiple awards for outstanding teaching, research, and outreach. Dr. Gibson has coauthored numerous articles in the *Journal of Business Logistics*, *Supply Chain Management Review*, *International Journal of Logistics Management*, and other leading industry publications. He is also the coauthor of three textbooks: *Supply Chain Management: A Logistics Perspective* (10e), *The Definitive Guide to Integrated Supply Chain Management*, and *Transportation*. He is actively engaged in executive education, seminar development, and consulting with leading organizations. Dr. Gibson currently serves as Secretary and Treasurer for the Council for Supply Chain Management Professionals, Education Advisor for the National Shippers Strategic Transportation Council, and Supply Chain Steering Committee Member for the Retail Industry Leaders Association. Dr. Gibson earned a BSBA from Central Michigan University, an MBA from Wayne State University, and a PhD in logistics and transportation from the University of Tennessee.

Yoshinori Suzuki is Dean's Professor of Supply Chain Management and associate chair of the Department of Supply Chain and Information Systems at the College of Business, Iowa State University. He holds a BS degree in Business and Economics from Sophia University (Tokyo Japan), an MBA degree in Marketing from New York University Stern School of Business, and a PhD degree in Business Logistics from The Pennsylvania State University Smeal College of Business. His research interest is in mathematical modeling of logistics and transportation problems. During his 20-year academic career, he has conducted numerous research projects with both private and public organizations, which include Ruan Transportation Management Systems, GROWMARK Inc., C.H. Robinson, Renewable Energy Group (REG), Des Moines International Airport, and

National Aeronautics and Space Administration (NASA). His recent research work has appeared in journals such as *Computers & Industrial Engineering*, *Transportation Research* (various parts), *Journal of Transportation Engineering*, *Naval Research Logistics*, *Decision Sciences*, *Decision Support Systems*, *Journal of Business Logistics*, *International Journal of Production Economics*, *Transportation Journal*, *Journal of the Transportation Research Forum*, and *International Journal of Physical Distribution and Logistics Management*. He has several years of industry experience. His work experience includes sales, logistics management, and transportation management duties. Dr. Suzuki is currently serving as the co-editor-in-chief of *Transportation Journal*.

John J. Coyle is director of corporate relations for the Center for Supply Chain Research (CSCR) and professor emeritus of Logistics and Supply Chain Management in the Smeal College of Business at Penn State University. He holds a BS and an MS from Penn State and earned his doctorate from Indiana University in Bloomington, Indiana, where he was a U.S. Steel Fellow. He joined the Penn State faculty in 1961 and attained the rank of full professor in 1967. In addition to his teaching responsibilities, he served in a number of administrative positions, including chairman of the Department of Business Logistics, faculty director and assistant dean for Undergraduate Programs, senior associate dean, and executive director of the CSCR. He also played a major role in the development of Smeal's Executive Education Programs. At the university level, he served as chairman of the Faculty Senate, Special Assistant for Strategic Planning to two university presidents (Jordan and Thomas). He also served as Penn State's faculty representative to the NCAA for 30 years and to the Big Ten for 10 years.

Dr. Coyle was the editor of the *Journal of Business Logistics* from 1990 to 1996. He has authored or coauthored 23 books or monographs and 38 articles in reputable professional journals. He has received 14 awards at Penn State for teaching excellence and/or advising. Former students and friends have endowed a scholarship fund and two Smeal Professorships in his honor. He received the Council of Logistics Management's Distinguished Service Award in 1991; Penn State's Continuing/Distance Education Award for Academic Excellence in 1994; the Eccles Medal for his contributions to the U.S. Department of Defense and the Lion's Paw Medal from Penn State for Distinguished Service, both in 2004. Dr. Coyle currently serves on the board of three logistics and supply chain companies.

The major driving forces of change for supply chains during the first two decades of the 21st century have been globalization and technology. That is not to say that there are not additional exogenous factors impacting supply chains and necessitating changes in managerial tactics and/or strategies because there have been. However, none have been of the magnitude of globalization and technology. Interestingly, they were major forces in the last two decades of the 20th century as was cited in previous editions of this text. The fact that they continue to have such an impact is certainly worth noting, but one must also appreciate the depth and scope of these two external forces not only on supply chains but also upon consumer and organizational behavior.

Transportation is an important part of supply chain management that has been described figuratively previously as the “glue” that holds the supply chain together and is a key enabler for important customer-oriented strategies such as overnight or same-day delivery. Transportation is often the final phase or process to touch the customer and may have a lasting impact on the success of the transaction. This is the micro dimension, but on a macro level transportation can be viewed as the “life blood” of global supply chains, and it has been argued that efficient and effective transportation is the most important business for a country or region and the cornerstone of a modern economy.

Global transportation systems have been seriously challenged in the 21st century by high fuel costs, changing capacity, and regulation. In addition, the transportation infrastructure, namely seaports, airports, highways, and so on, is not sufficient to accommodate the flow of global commerce in many countries thus stymying the economic progress of the region. Many parts of the infrastructure require government or public funding because of the different users. The public coffers are frequently financially strained because of the many alternative demands for these somewhat limited resources. Transportation infrastructure has to “compete” for an allocation of public funds, and the benefits, while real, are more long run in terms of outcome and value. Consequently, such needed resources might not be allocated in a timely manner. This is the dilemma of the 21st century. Transportation and the related logistics systems are a necessary requirement for all economies, developed and underdeveloped, but the public investment in social capital necessary to not only improve but also sustain the infrastructure has not been forthcoming in many countries. Hopefully, one of the outcomes of this text will be a better understanding and appreciation for the criticality of efficient and effective transportation systems for economic development and social welfare.

Part I will provide an overview and foundation for the role and importance of improved transportation from a micro and macro perspective in global supply chains. The discussion will cover economic and managerial dimensions of

transportation in the global economy. Part I is designed to provide the framework for the analysis and discussion in the following sections of the book.

Chapter 1 examines the nature, importance, and critical issues in the global economy, which are important to understand for the current and future transportation systems, that will provide the needed service for the diverse requirements of the various regions and countries. This chapter will also discuss the special nature of transportation demand and how transportation adds value to products. There is also an overview of the concept of supply chain management and the important role of transportation in supply chains of various organizations.

Chapter 2 examines the role of transportation from a macro and micro perspective. The chapter adds to the discussion in Chapter 1 but explores more broadly the special significance of improved transportation systems. The analysis includes not only the economic impact but also the political and social impact of transportation. Current and historical perspectives are provided in the discussion to help the reader appreciate and better understand the contribution of improved transportation in an economy. The discussion also examines the impact of improved transportation upon land values and prices of products and services.

Chapter 3 is new and provides an overview of the technology and systems currently in use and planned for execution in the transportation sector. Special attention is given to the technology used in the various modes, including On-Board Recorders (OBRs) and driverless vehicles in the motor carrier industry and Positive Train Control (PTC) in the railroad industry. The discussion also emphasizes the impact the various technologies have had on transportation efficiency.

Chapter 4 extends the discussion of costing and pricing introduced in Chapters 1 and 2. Given the importance of transportation on a micro and macro level to the cost and value of products and services, costing and pricing deserves a more detailed examination. There are unique dimensions to transportation services in general and between the basic modes that need to be understood by managers and public officials. Chapter 4 provides an analysis of the differences and unique dimensions of transportation services.

CHAPTER

1

GLOBAL SUPPLY CHAINS: THE ROLE AND IMPORTANCE OF TRANSPORTATION

Learning Objectives

After reading this chapter, you should be able to do the following:

- › Appreciate why efficient transportation systems are so critical to advance the growth and development of regions and countries, and how they contribute to social and political systems as well as national defense
- › Discuss the importance of transportation to globalization and how it contributes to the effective flow of commerce among close and distant regions
- › Understand how global supply chains can contribute to the competitive position of countries and allow them to penetrate global markets
- › Appreciate the dynamic nature of the global economy, which can impact and change the competitive position of a region or country in a relatively short period of time
- › Explain the underlying economic basis for international exchange of goods and services for the overall benefit of two or more countries or regions and gain some perspective on the volume and overall importance of the more advanced countries of the world
- › Discuss the size and age distribution of the population and the growth rate of the major countries of the world and understand how the size of the population can impact a country positively or negatively
- › Understand the challenges and opportunities associated with the worldwide growth in urbanization and why there has been such a major shift from rural to urban areas

- › Appreciate the importance and impact of land and resources to the economic advancement and development of the various countries of the world and how they can be exploited to their advantage
- › Explain why technology has become such an important ingredient for the economic progress of companies and countries in today's global economy and understand the need for and types of technology
- › Discuss the overall characteristics and importance of globalization and supply chains in the highly competitive world economies of the 21st century

TRANSPORTATION PROFILE

Critical Role of Transportation in Global Economy

Transportation is one of the most important tools or methods that developing societies or countries use to advance economically, politically, and socially. It impacts every phase and facet of our existence. Transportation is probably the most important industry in any country or in the global economy. Without it, we could not operate a grocery store or run a factory. The more complex or developed a country is, the more indispensable an efficient and effective transportation system is for continued survival and growth.

In advanced societies, transportation systems are so well developed that most citizens do not think about or realize the many benefits that accrue from good transportation systems. They use transportation everyday directly or indirectly. It provides the thoroughfare for commerce, the means of travel locally or for longer distances, and the assistance for many other important aspects of their lives. People seldom stop to think how restricted their lives would be without good transportation. However, if one travels to an underdeveloped country, it is obvious that the lack of good transportation is inhibiting their economic prosperity and personal convenience. The current physical decay of the highway infrastructure in the United States and the lack of investment for improvement is a critical concern to many private and public organizations because of its importance to continued economic growth and global expansion.

The development of the global economy has increased the criticality of transportation for economic, political, and national defense purposes. Globalization has brought many benefits to countries throughout the world, but we are much more interdependent and at risk when some calamity occurs in another part of the world that can interrupt supply of raw materials or finished products and/or shut down a market for domestic products. Efficient and effective transportation can help to mitigate the impact, for example, of a natural disaster such as a hurricane, typhoon, or flood by providing products and services from alternate sources and access to other markets quickly and efficiently.

The importance of transportation cannot be overemphasized. It is a necessary ingredient for the progress and well-being of all citizens. An appreciation and understanding of its historical and economic role and significance, as well its political and social significance, is a requisite for managers in any organization and other interested parties. An appreciation of this tenet will be an important part of the discussion in this text.

Introduction

In previous editions of this text, transportation was referred to as the “glue” that holds the supply chain together and an enabler of the underlying tactics and strategies that have catapulted supply chain management to the level of acceptance, which it now enjoys in many organizations, both private and public. For example, transportation management systems technology along with complimentary software is used by many organizations to improve logistics and supply chain efficiency, effectiveness, and execution. Transportation has moved from playing a reactive or supporting role to a role that is more proactive and enabling. In other words, transportation has become much more strategic for organizations in determining their ability to compete in the growing and complex global marketplace.

The global marketplace is also changing on a continuing basis, that is, it has become very dynamic, and is buffeted by economic, political, social, and natural forces, which can impact a country or region negatively or positively in the short or long run. For example, the high cost of fuel has impacted the rates charged by transportation service providers, which in turn impacts the distance that it is economically feasible to transport goods. The cost of labor can change over time to the disadvantage of some geographic areas and benefit others. For example, the labor cost advantage that China enjoyed, along with low rates for ocean carrier movement, had a positive impact on their ability to sell products on a global basis. These advantages have diminished somewhat allowing other countries to develop an improved competitive position because of market proximity, labor costs, or other factors. These changes in turn impact global supply chains and their associated flow of goods.

In this chapter, the initial focus will be upon developing an overview of the flow of global commerce and trade overtime on a worldwide basis not only to understand the importance and magnitude of global supply chain flows but also to gain some perspective on important changes that have occurred. A variety of economic data will be used to illustrate the impact of the overall changes that have occurred. The next section will examine the underlying rationale and economics of global flows of goods and services. In other words, the “why” of global flows will be discussed to understand the advantages of international trade to countries and consumers in contrast to the “what” of the first section of this chapter. The third section will provide additional insights into the factors that can contribute to the economic advancement and development of countries. The final section of the chapter will provide an overview of the supply chain concept including its development, key characteristics, and major activities.

Global Supply Chain Flows

Early in the 21st century, frequent reference was made to acronyms such as the BRIC (Brazil, Russia, India, and China) or VISTA (Vietnam, Indonesia, South Africa, Turkey, and Argentina) countries. The former were identified as the top emerging economies and the latter as those developing at a fast pace. The development of the BRIC and VISTA countries was seen an indication of opportunities for “sourcing” of materials, products, and services and the identification of potential markets for the more developed economies such as the United States, the European Union (EU), and Japan. Also, they were a sign of a more economic balance in the world and continued growth. Consequently, one noted author¹ declared that the world was really flat because of the developing economies. Interestingly, there have been some economic shifts already with respect to these countries, and the future importance of some of the VISTA countries is not clear. For example, South Africa has

been added to the first group, BRICS, by some economic pundits. Nevertheless, all of this supports the observation made earlier about the dynamic and competitive nature of world markets. An important caveat is the potential for disruption caused by political instability, associated acts of terrorism, and military actions, which can cause a major disruption in global trade flows.

Figure 1-1 and Table 1-1 indicate export trade flows of merchandise from various country or region origins. In Figure 1-1, the size of the circle indicates the importance and volume of exports on a worldwide basis. It is interesting to note the large number of exporting countries and the big differences in the volume. Table 1-1 shows the value of world exports in U.S. dollars. China is clearly number one for exports of merchandise and the United States is second, but what may be surprising is Germany being third. They are relatively close to the United States in terms of the value of their exports. If we added up the value of exports for all the EU countries, it would by far exceed the United States (about double). The EU also compares favorably to the Asian block of countries in terms of exports.

Figure 1-2 and Table 1-2 show the import trade flows of merchandise into various countries and regions. Figure 1-2 is interesting because it is a visual representation of the magnitude of the value of imports and provides some perspective of the differences in the world markets. In terms of regions, Exhibit 1-2 indicates that Asia is the largest importing region and is followed by the EU. North America is third in terms of the value of imports. Among individual countries, the United States is the largest importer, followed by China and then Germany.

A comparison of relative shares of imports and exports provides some additional perspectives. China's share of global exports in terms of value is 13.8 percent and their share of imports is 10.1 percent making them a net exporter, whereas the United States by comparison is a net importer with 9.1 percent of merchandise exports and 13.8 percent of the global imports. Germany is also a net exporter with exports representing 8.1 percent of the global

FIGURE 1-1 Export–Trade Flows of Merchandise

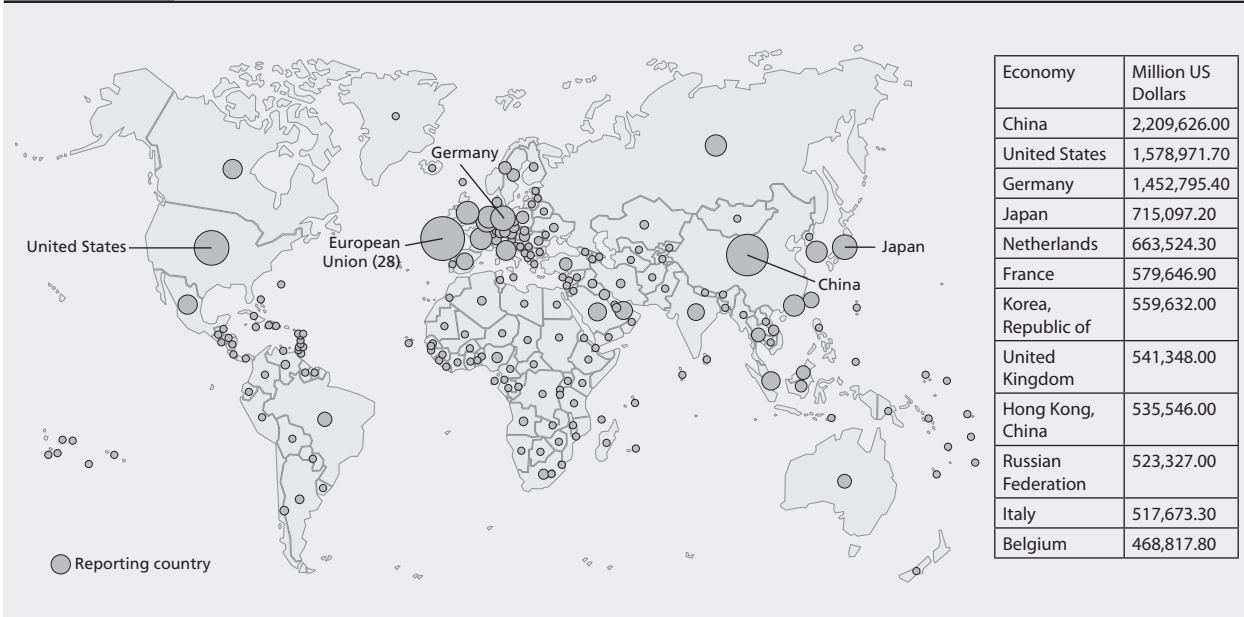


FIGURE 1-2 Import–Trade Flows of Merchandise



total with imports of 6.3 percent of the total. There are economic implications associated with these differences, but the merchandise flows do not provide a complete economic picture because the value of services imported and exported are also important for the balance of payments of individual countries. However, the focus of this text is obviously upon merchandise flows.

The importance of the so-called developed countries/economies is evident from the information presented earlier, but additional insight can be gained by summarizing the impact of the top countries in each category (see Tables 1-1 and 1-2). In 2015, the top 30 exporting countries accounted for 84 percent of the world's exports, but the top three (China, United States, and Germany) accounted for about 31 percent of the total exports. The top 30 importing countries accounted for 82.1 percent of the total imports, but the top three (United States, China, and Germany) accounted for 30.1 percent of the total imports. The data presented in Tables 1-1 and 1-2 substantiate the observation about the important role of developed economies made earlier.

Additional insight can be gained by examining the growth in the volume of global trade over the course of the last 47 years (see Table 1-3). The 30-year growth from 1970 to 1999 was steady. In recent years, especially the period from 2000 to the present, the growth has been spectacular, except for a decline in export growth in 2001 and the global recession in 2009. The total volume of trade more than doubled, led by China, Japan, the United States, and the EU. A number of factors came into play to explain the increased growth rate including trade agreements among countries along with a reduction in tariffs, which promoted global trade and its associated benefits. There was also greater acceptance of importing finished products that were manufactured in foreign countries.

Traditionally, many countries imported raw materials that were scarce or not available in the importing country, and they then produced finished products mostly for domestic consumption. The raw materials were much lower in value than the finished products that contributed to the imbalance of trade among developing and developed economies.

RANK	EXPORTERS	VALUE	SHARE	ANNUAL % CHANGE
1	China	2,275	13.8	-3
2	United States	1,505	9.1	-7
3	Germany	1,329	8.1	-11
4	Japan	625	3.8	-9
5	Netherlands	567	3.4	-16
6	Korea, Republic of	527	3.2	-8
7	Hong Kong, China	511	3.1	-3
8	France	506	3.1	-13
9	United Kingdom	460	2.8	-9
10	Italy	459	2.8	-13
11	Canada	408	2.5	-14
12	Belgium	398	2.4	-16
13	Mexico	381	2.3	-4
14	Singapore	351	2.1	-14
15	Russian Federation	340	2.1	-32
16	Switzerland	290	1.8	-7
17	Chinese Taipei	285	1.7	-11
18	Spain	282	1.7	-13
19	India	267	1.6	-17
20	United Arab Emirates	265	1.6	-29
21	Thailand	214	1.3	-6
22	Saudi Arabia, Kingdom of	202	1.2	-41
23	Malaysia	200	1.2	-15
24	Poland	198	1.2	-10
25	Brazil	191	1.2	-15
26	Australia	188	1.1	-22
27	Vietnam	162	1.0	8
28	Czech Republic	158	1.0	-10
29	Austria	152	0.9	-15
30	Indonesia	150	0.9	-15
	World	16,482	100.0	-

Source: World Trade Organization.

However, that situation has changed, countries that previously imported materials for domestic production and consumption are exporting more finished products while so-called underdeveloped countries are participating more in manufacturing, especially of parts of a finished product. A very good example is the automobile industry. The typical automobile of today has over 10,000 parts, which can be manufactured in many different countries. Furthermore, the individual parts may be exported and put together into subassemblies that are frequently shipped to an assembly plant in another location. So a Ford assembled in Detroit

RANK	IMPORTERS	VALUE	SHARE	ANNUAL % CHANGE
1	United States	2,308	13.8	-4
2	China	1,682	10.1	-14
3	Germany	1,050	6.3	-13
4	Japan	648	3.9	-20
5	United Kingdom	626	3.7	-9
6	France	573	3.4	-15
7	Hong Kong, China	559	3.3	-7
8	Netherlands	506	3.0	-14
9	Korea, Republic of	436	2.6	-17
10	Canada	436	2.6	-9
11	Italy	409	2.4	-14
12	Mexico	405	2.4	-2
13	India	392	2.3	-15
14	Belgium	375	2.2	-17
15	Spain	309	1.8	-14
16	Singapore	297	1.8	-19
17	Switzerland	252	1.5	-9
18	Chinese Taipei	238	1.4	-16
19	United Arab Emirates	230	1.4	-8
20	Australia	208	1.2	-12
21	Turkey	207	1.2	-14
22	Thailand	203	1.2	-11
23	Russian Federation	194	1.2	-37
24	Poland	193	1.2	-14
25	Brazil	179	1.1	-25
26	Malaysia	176	1.1	-16
27	Saudi Arabia, Kingdom of	172	1.0	-1
28	Vietnam	166	1.0	12
29	Austria	155	0.9	-15
30	Indonesia	143	0.9	-20
	World	16,725	100.0	-

Source: World Trade Organization.

may have less U.S.-made parts than a Toyota assembled in Mexico. The efficiency of global supply chains and especially the transportation systems afford these more complex operations as compared to an earlier era when the auto parts were produced in locations which were more contiguous to the assembly plants. This is also an excellent example of companies using logistics systems analysis to evaluate the trade-offs among production costs, transportation services, and inventory carrying costs to arrive at the overall best location for efficiency and effectiveness.