EIGHTH EDITION

TRANSPORTATION

A GLOBAL SUPPLY CHAIN PERSPECTIVE

COYLE | NOVACK | GIBSON

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A very special note of thanks and appreciation is due to our families. John Coyle would like to thank his wife Barbara, their children John and Susan, and their grandchildren Lauren, Matthew, Elizabeth Kate, Emily, Ben, Cathryn, and Zachary. Bob Novack would like to thank his wife Judith and their children Tom, Elizabeth, and Alex. Brian Gibson would like to recognize his wife Marcia, son Andy, and his longtime mentor, Dr. Bob Cook (1947–2014). Special mention should be made in reference to Dr. Edward J. Bardi to express our deep appreciation of his many contributions not only to the continuing development of this text but also to the supply chain management text.

Brief Contents

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Preface

This textbook is required by the American Society of Transportation and Logistics® for the Transportation Economics Management module in the Certified in Transportation and Logistics (CTL) professional certification program. For details go to www.astl.org.

In this book *Transportation: A Global Supply Chain Perspective* while attention was paid to the global aspect of transportation in previous editions, especially the seventh edition, the authors realized that the global dimension required even more emphasis to reflect the increased challenges and requirements of 21st century supply chains. Transportation has become even more important for efficient and effective supply chains in today's complex and competitive global environment. It has become the critical link in successful supply chains and may be the most important industry for the economic advancement in the economies of the world. The authors are convinced much more attention and focus must be given to transportation infrastructure investment to meet the needs of the global economy.

The text follows the format of the previous edition with three sections and 14 chapters, but substantive additions and changes have been made to enhance the global discussions, improve the content and organization, and streamline and update relevant parts of text. Part I provides the foundation for the overall text. Chapter 1 explores global thrust of this edition examining key critical areas such as population trends and related issues for developing and developed economies. Chapter 2 provides the economic foundation and rationale for the role of transportation as well as its political and social importance. Chapter 3 explores the regulatory and public policy issues associated with transportation while 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 provide some inherent advantages for shippers of particular commodities or locations that need to be appreciated and understood to gain the economic benefits they offer. The competitive environment of market that exists in some economies provides a dynamic that promotes continual change and improvement in the services that can be offered by the basic modes.

The chapters in Part III were significantly changed in the previous edition, which enhanced the overall text. The six chapters in this section have been updated and revised to further improve their value to the readers. Chapter 9 discusses the topic of risk management that has become a critical focus for many organizations because of the increasing threats to the interruption of supply chain flows in the global economy. Strategies, methods, and outcomes for risk management are explored as well as overall security. Chapters 10 and 11 provide an important and in-depth discussion of the planning and execution for efficient and effective global transportation flows with emphasis on flexibility, documentation, intermodal options, and service providers. Chapters 12 and 13 add to the information provided in Part II with a detailed discussion of third-party service providers and private transportation respectively. Both are options that can improve efficiency, effectiveness, and execution for global supply chains, especially transportation and logistics services. Finally, Chapter 14 explores some of the major challenges and issues for transportation in the 21st century, namely, infrastructure, environmental sustainability, and technology. While all of these topics were discussed to some extent in

previous chapters, the authors felt that they deserved more attention as we move ahead in our complex and competitive global environment.

Overall, we are convinced that transportation is a critical ingredient on many levels but is often taken for granted unless some 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 also 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.cengage.com/decisionsciences/coyle) 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.

Acknowledgements

The authors are indebted to many individuals at our respective academic institutions as well as other individuals with whom we have had contact in a variety of venues. Our university students and our executive program students have provided an important sounding board for the many concepts, techniques, metrics, and strategies presented in

the book. Our faculty and corporate colleagues have provided invaluable insights and appropriate criticism of our ideas. Some individuals deserve special consideration: Nicholas F. Hood (Penn State), Ms. Tracie Shannon (Penn State), and Kusumal Ruamsook (Penn State). The authors would also like to thank the following fellow faculty members for their insightful contributions to several chapters in this text: John C. Spychalski, Professor Emeritus of Supply Chain Management (Penn State), and Joe Hanna, Associate Dean and Professor of Supply Chain Management (Auburn).

About the Authors

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 B.S. and an M.S. 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 ten 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.

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 Ph.D. 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 a professor of Supply Chain Management and Executive Director of the Supply Chain Resource Center 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 has ten years of experience 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, most notably the Teaching Innovations Award from the Council of Supply Chain Management Professionals in 2009. Dr. Gibson has coauthored more than 50 refereed and invited articles in the *Journal of Business Logistics*, *Supply Chain Management Review*, *International Journal of Logistics Management*, *International Journal of Physical Distribution and Logistics Management*, and other leading publications. He is actively engaged in executive education, seminar development, and consulting with leading organizations. Dr. Gibson currently serves in leadership roles for the Council for Supply Chain Management Professionals, the National Shippers Strategic Transportation Council, and the Retail Industry Leaders Association. Dr. Gibson earned a B.S.B.A. from Central Michigan University, an MBA from Wayne State University, and a Ph.D. in logistics and transportation from the University of Tennessee.

PART I

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 escalating fuel costs along with volatility in fuel prices. 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 may 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 to 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, including regulation and public policy issues. 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 provides an overview and examines the development and role government regulation and public policy directed at transportation services, particularly in the United States. Local, state, and federal regulation of private transportation companies has been in existence since the 19th century in the United States countries. These controls are on one level a recognition of the importance of transportation to the development and ongoing vitality of an economy. In many countries of the world, important parts of the transportation system are provided by the government. This is especially true of railroad and air carrier service. There have been major changes in the regulatory structure in the United States and elsewhere, but regulations, particularly in the area of safety, continue to play a role that needs to be understood.

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 rising 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 author[1] 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.

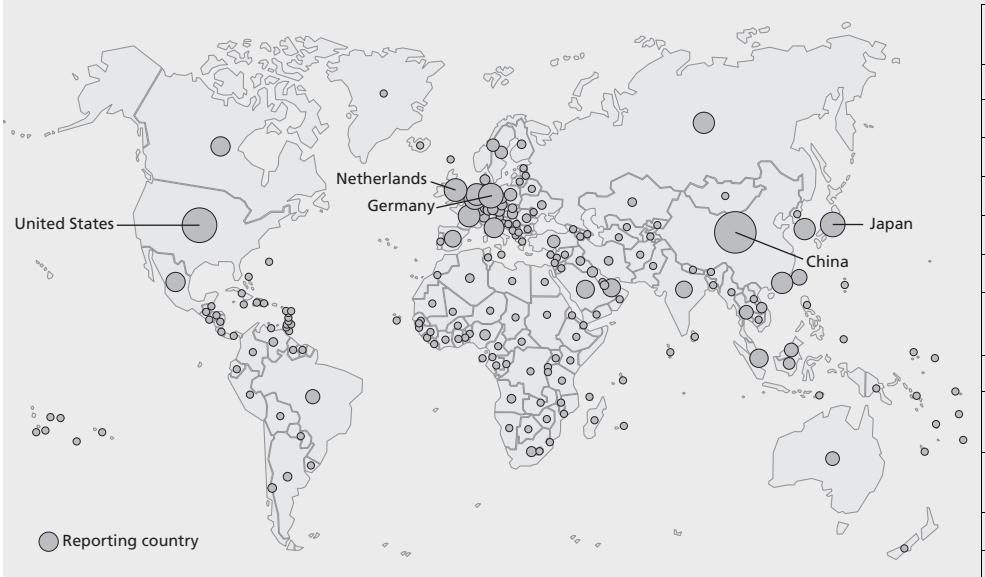
For example, South Africa has been added to the first group, BRICS, by some economic pundits. Nevertheless, all of this supports the observation made earlier about the dynamic and competitive nature of world markets. An important caveat is the potential for disruption caused by political instability,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

Figure 1-1 and Exhibit 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. Exhibit 1-1 and the associated bar chart show 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 Exhibit 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 11.8 percent and their share of imports is 10.3 percent making them a net exporter, whereas the United States by comparison is a net importer with 8.4 percent of merchandise exports and 12.4 percent of the global imports. Germany is also a net exporter with exports representing 7.7 percent of the global total with imports of 6.3 percent of the total. There are economic

FIGURE 1-1 Export-Trade Flows of Merchandise



Economy	Million US Dollars
China	2,209,626.00
United States	1,578,971.70
Germany	1,452,795.40
Japan	715,097.20
Netherlands	663,524.30
France	579,646.90
Korea, Republic of	559,632.00
United Kingdom	541,348.00
Hong Kong, China	535,546.00
Russian Federation	523,327.00
Italy	517,673.30
Belgium	468,817.80

FIGURE 1-2 Import-Trade Flows of Merchandise

Economy	Million US Dollars
United States	2,329,059.80
China	1,949,992.00
Germany	1,188,883.80
Japan	833,166.10
France	681,016.00
United Kingdom	655,318.60
Hong Kong, China	622,276.40
Netherlands	589,768.10
Korea, Republic of	515,586.00
Italy	477,391.50
Canada	474,270.00
India	466,042.10
Belgium	450,706.00

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 2013, the top 30 exporting countries accounted for 81.7 percent of the world's exports, but the top three (China, United States, and Germany) accounted for about 30 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 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 50 years (see Table 1-3). The 30-year growth from 1960 to 1990 was steady, but in recent years, especially the period from 2000 to the present, the growth has been spectacular. 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. However, that situation has changed, countries that previously imported materials for domestic production and consumption are exporting more finished

TABLE 1-1 Top 30 Exporters, 2013

RANK	EXPORTERS	VALUE	SHARE	ANNUAL % CHANGE
1	China	2210	11.8	8
2	United States	1579	8.4	2
3	Germany	1453	7.7	3
4	Japan	715	3.8	–10
5	Netherlands	664	3.5	1
6	France	580	3.1	2
7	Korea, Republic of	560	3.0	2
8	United Kingdom	541	2.9	15
9	Hong Kong, China	536	2.9	9
	- domestic exports	20	0.1	–11
	- re-exports	516	2.7	10
10	Russian Federation	523	2.8	–1
11	Italy	518	2.8	3
12	Belgium	469	2.5	5
13	Canada	458	2.4	1
14	Singapore	410	2.2	0
	- domestic exports	219	1.2	–4
	- re-exports	191	1.0	6
15	Mexico	380	2.0	3
16	Saudi Arabia, Kingdom of c	376	2.0	–3
17	United Arab Emirates c	365	1.9	4
18	Spain	316	1.7	7
19	India	312	1.7	5
20	Chinese Taipei	305	1.6	1
21	Australia	253	1.3	–1
22	Brazil	242	1.3	0
23	Switzerland	229	1.2	1
24	Thailand	229	1.2	0
25	Malaysia	228	1.2	0
26	Poland	202	1.1	9
27	Indonesia	184	1.0	–3
28	Austria	174	0.9	5
29	Sweden	167	0.9	–3
30	Czech Republic	161	0.9	3
	Total of above d	15339	81.7	–
	World d	18784	100.0	2

Source: World Trade Organization.

TABLE 1-2 Top 30 Importers, 2013

RANK	IMPORTERS	VALUE	SHARE	ANNUAL % CHANGE
1	United States	2331	12.4	0
2	China	1950	10.3	7
3	Germany	1187	6.3	2
4	Japan	833	4.4	–6
5	France	681	3.6	1
6	United Kingdom	654	3.5	–5
7	Hong Kong, China	622	3.3	12
	- retained imports	141	0.7	4
8	Netherlands	590	3.1	0
9	Korea, Republic of	516	2.7	–1
10	Italy	477	2.5	–2
11	Canada a	474	2.5	0
12	India	466	2.5	–5
13	Belgium	450	2.4	3
14	Mexico	391	2.1	3
15	Singapore	373	2.0	–2
	- retained imports b	182	1.0	–9
16	Russian Federation a	344	1.8	3
17	Spain	339	1.8	0
18	Chinese Taipei	270	1.4	0
19	Turkey	252	1.3	6
20	Thailand	251	1.3	0
21	Brazil	250	1.3	7
22	United Arab Emirates c	245	1.3	7
23	Australia	242	1.3	–7
24	Malaysia	206	1.1	5
25	Poland	204	1.1	2
26	Switzerland	200	1.1	1
27	Indonesia	187	1.0	–2
28	Austria	182	1.0	2
29	Saudi Arabia, Kingdom of	164	0.9	5
30	Sweden	158	0.8	–3
	Total of above d	15492	82.1	–
	World d	18874	100.0	1

Source: World Trade Organization.

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