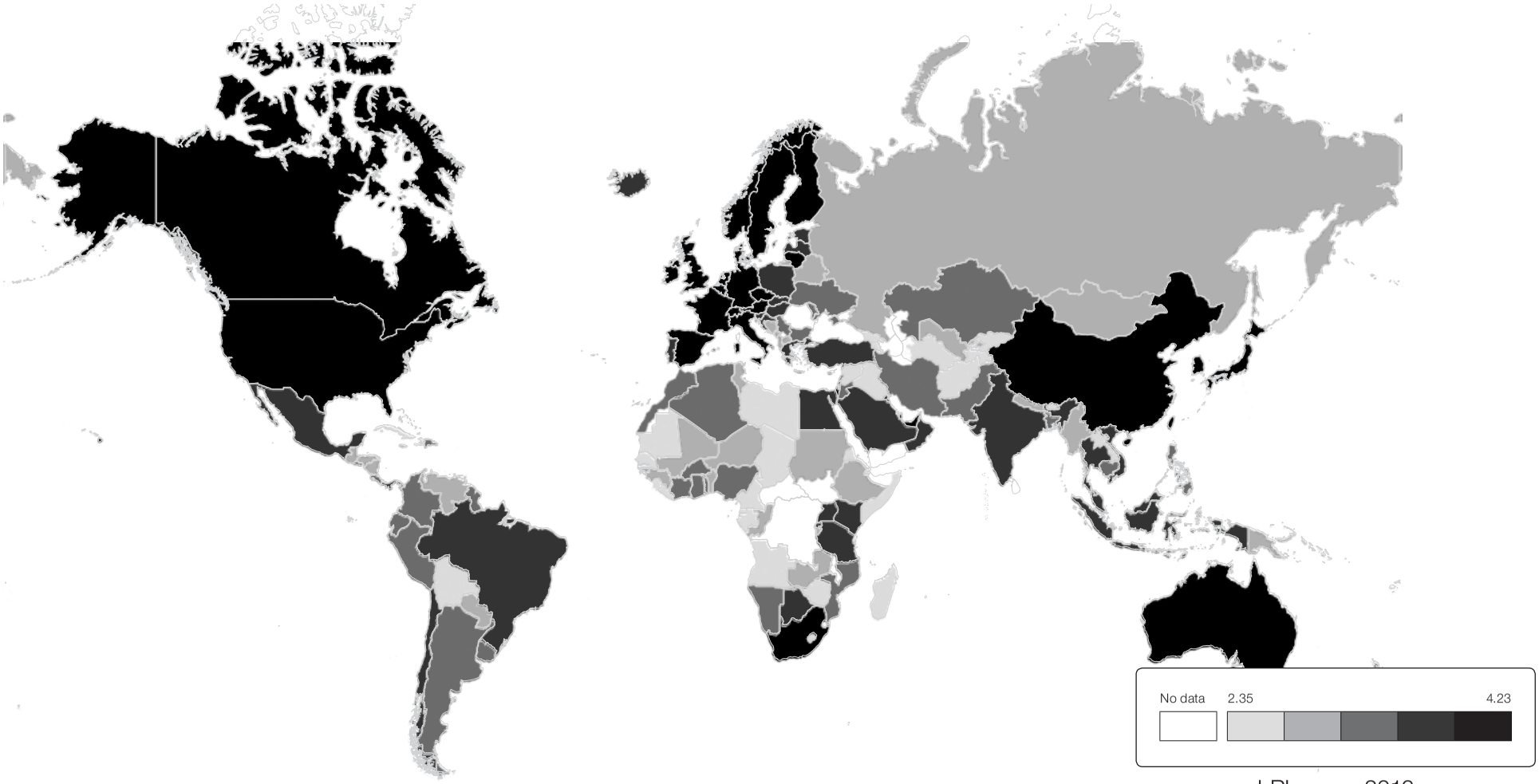
Connecting to Compete

2016

Trade Logistics in the Global Economy

The Logistics Performance Index and Its Indicators



LPI score, 2016
(1 is the lowest score;
5 is the highest score)

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The Logistics Performance Index and Its Indicators

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Foreword

Anabel González, Senior Director, Trade & Competitiveness Global Practice, The World Bank Group

I am pleased to introduce the fifth edition of *Connecting to Compete: Trade Logistics in the Global Economy*. The *Connecting to Compete* series features the Logistics Performance Index (LPI), a comprehensive measure of the efficiency of international supply chains. Its first version was published in 2007, and it has since been updated every two years.

Logistics organizes the movement of goods through a network of activities and services operating at global, regional, and local scale. Logistics encompasses more than freight transportation. Traders delegate increasingly sophisticated tasks to networks of specialized service providers. Efficient logistics connects people and firms to markets and opportunities and helps achieve higher levels of productivity and welfare.

Crucially, logistics is not only a private endeavor, but also a public policy concern. The performance and reliability of supply chains depend on an array of interventions, ranging from trade facilitation at the border to infrastructure and regulations and to urban planning and skills. Empirical evidence confirms that logistics- and connectivity-related interventions have the highest potential to reduce the cost of trade and to boost integration in global value chains.

Today, policy makers know that logistics matters and that they can improve the efficiency of the supply chains connecting their countries internally and externally. As a former government official, I can confirm that the previous editions of the LPI, indeed, contributed to this awareness by proposing a synthetic understanding of the intricate reality of supply chain networks.

After almost 10 years, the LPI remains highly relevant. The *Connecting to Compete* report has initiated and facilitated numerous policy reforms around the globe. But the LPI should not be overinterpreted beyond its role as a global benchmark. It is not a substitute for in-depth country diagnoses. For this, the World Bank and others have proposed thorough and adequate methodologies such as the Trade and Transport Facilitation Assessment. The increasing availability of data, including big data, opens new opportunities to disentangle supply chains in specific country contexts and at detailed industry or geographical levels.

Building on a rich set of information, the report shows that improving logistics performance is a complex, unfinished, cross-cutting, and evolving agenda. The priorities depend on country performance. Countries with the worst performance are dealing with comparatively basic trade and transport facilitation reforms, which the World Bank and partner agencies support in many places. Middle- and high-income economies are dealing with new concerns, which the *Connecting to Compete* report echoes: sustainable logistics, distribution and urban logistics, skill development and training, and domestic and international connectivity bottlenecks.

Any effective action in logistics policies should be the result of coordinated efforts between the private and public sectors. In this regard, the support of the International Federation of Freight Forwarders Associations (FIATA) to undertake this new edition of the *Connecting to Compete* report has been invaluable.

I sincerely hope the LPI and this biennial report will continue to provide useful knowledge to policy makers, private sector executives, and others interested in how to make supply chains work more efficiently for the benefit of all.

Anabel González
Senior Director
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Foreword

Huxiang Zhao, President, International Federation of Freight Forwarders Associations (FIATA)

I have been asked to make comments on the new publication of the Logistics Performance Index in my role as President of FIATA. This is a much needed tool for decision makers to consider when decisions on logistics capacity and quality need to be made. The LPI is unique as a tool of decision making since it expresses the perception of operators on the ground; this is often as important as hard statistical data.

FIATA, in representing freight forwarders and logistics service providers globally, is pleased to have been a part of the development of this 2016 edition, and we are grateful to the LPI team for their continued trust, which is now spanning a number of years.

The LPI is instrumental in the policy choices of governments, nongovernmental organizations, and private enterprises worldwide, and the visibility of the freight forwarding and logistics sector as an intrinsic arm of global trade and commerce is crucial. There is no trade without logistics, and poor logistics often means poor trade. We must remember that moving goods across borders is not the be-all and end-all of logistics performance, which requires the integration of many elements throughout the entire supply chain.

The challenge is to ensure that the LPI and all the insight into markets it contains reaches decision makers not only in the public sector but also in the private sector to avoid that the public sector caters for misconceived private demand; in this regard the role of large and global organizations such as FIATA is crucial.

We trust the 2016 Logistics Performance Index will be well received by policy makers and private sector decision makers alike. FIATA is proud to congratulate those members who replied by providing necessary information and is grateful to the World Bank for the opportunity to contribute to this priceless initiative.

Huxiang Zhao
President, International Federation of Freight Forwarders Associations (FIATA)

Acknowledgments

This report has been prepared by the World Bank's Global Trade Team under the guidance of Anabel González (Senior Director) and José Guilherme Reis (Practice Manager). The project leaders were Jean-François Arvis (jarvis1@worldbank.org) and Daniel Saslavsky (dsaslavsky@worldbank.org). Authors included Professor Lauri Ojala (Turku School of Economics, University of Turku; lauri.ojala@utu.fi), Ben Shepherd (Principal, Developing Trade Consultants; ben@developing-trade.com), Anasuya Raj (anasuyaraj.14@gmail.com), Christina Busch (cbusch@worldbank.org), and Tapio Naula (tapio.naula@tradelogistics.fi). Carolina Monsalve and Kamal Siblini were peer reviewers for this edition's project concept note.

The LPI survey would not have been possible without the support and participation of the International Federation of Freight Forwarders Associations (http://fiata.com/), namely, Marco Sorgetti, FIATA's Director General and CEO. National freight forwarding associations and a large group of small, medium, and large logistics companies worldwide were also instrumental in disseminating the survey. The survey was designed with Finland's Turku School of Economics, University of Turku (http://www.utu.fi/en/), which has worked with the World Bank since 2000 to develop the concept.

The authors are also grateful to external colleagues for their support and contributions in reaching out to forwarding associations and providing inputs for the report, including Ruth Banomyong (Thammasat University, Thailand), Nicolette Van der Jagt (CLECAT, European Association for Forwarding, Transport, Logistics, and Customs Services), and Cesar Lavalle (ILOS Brazil). Jan Havenga (Department of Logistics, Stellenbosch University, South Africa) provided inputs on the Logistics Barometer South Africa. Daniel Cramer of BlueTundra.com designed, developed, and maintained the LPI survey and results websites under the guidance of the core team. Scott Johnson of the World Bank Information Solutions Group helped the team distribute the survey. The report has been edited, designed, and laid out by Communications Development Incorporated.

The authors thank the hundreds of employees of freight forwarding and express carrier companies around the world who responded to the survey. Their participation was central to the quality and credibility of the project, and their continuing feedback will be essential as we develop and refine the survey and the LPI in years to come.

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LPI ranking and scores, 2016

Economy	2016 LPI Rank	Score	% of highest performer	Economy	2016 LPI Rank	Score	% of highest performer	Economy	2016 LPI Rank	Score	% of highest performer
Germany	1	4.23	100.0	Brazil	55	3.09	64.7	Mali	109	2.50	46.6
Luxembourg	2	4.22	99.8	Malta	56	3.07	64.1	Tunisia	110	2.50	46.4
Sweden	3	4.20	99.3	Botswana	57	3.05	63.4	Guatemala	111	2.48	45.8
Netherlands	4	4.19	98.8	Uganda	58	3.04	63.3	Honduras	112	2.46	45.3
Singapore	5	4.14	97.4	Cyprus	59	3.00	62.0	Myanmar	113	2.46	45.2
Belgium	6	4.11	96.4	Romania	60	2.99	61.8	Zambia	114	2.43	44.3
Austria	7	4.10	96.0	Tanzania	61	2.99	61.7	Benin	115	2.43	44.3
United Kingdom	8	4.07	95.2	Rwanda	62	2.99	61.6	Solomon Islands	116	2.42	43.9
Hong Kong SAR, China	9	4.07	95.1	Indonesia	63	2.98	61.5	Albania	117	2.41	43.8
United States	10	3.99	92.8	Vietnam	64	2.98	61.3	Uzbekistan	118	2.40	43.5
Switzerland	11	3.99	92.6	Uruguay	65	2.97	61.2	Jamaica	119	2.40	43.4
Japan	12	3.97	92.1	Argentina	66	2.96	60.8	Belarus	120	2.40	43.4
United Arab Emirates	13	3.94	91.2	Jordan	67	2.96	60.7	Trinidad and Tobago	121	2.40	43.3
Canada	14	3.93	90.8	Pakistan	68	2.92	59.6	Venezuela, RB	122	2.39	43.1
Finland	15	3.92	90.5	Peru	69	2.89	58.7	Montenegro	123	2.38	42.8
France	16	3.90	89.9	Brunei Darussalam	70	2.87	58.0	Nepal	124	2.38	42.7
Denmark	17	3.82	87.3	Philippines	71	2.86	57.5	Congo, Rep.	125	2.38	42.7
Ireland	18	3.79	86.6	Bulgaria	72	2.81	56.0	Ethiopia	126	2.38	42.7
Australia	19	3.79	86.6	Cambodia	73	2.80	55.8	Congo, Dem. Rep.	127	2.38	42.6
South Africa	20	3.78	86.0	Ecuador	74	2.78	55.1	Guinea-Bissau	128	2.37	42.5
Italy	21	3.76	85.4	Algeria	75	2.77	54.9	Guinea	129	2.36	42.1
Norway	22	3.73	84.7	Serbia	76	2.76	54.6	Georgia	130	2.35	41.9
Spain	23	3.73	84.5	Kazakhstan	77	2.75	54.3	Cuba	131	2.35	41.7
Korea, Rep.	24	3.72	84.2	Bahamas, The	78	2.75	54.2	Senegal	132	2.33	41.2
Taiwan, China	25	3.70	83.6	Namibia	79	2.74	54.1	São Tomé and Príncipe	133	2.33	41.1
Czech Republic	26	3.67	82.9	Ukraine	80	2.74	53.8	Djibouti	134	2.32	41.0
China	27	3.66	82.5	Burkina Faso	81	2.73	53.7	Bhutan	135	2.32	41.0
Israel	28	3.66	82.5	Lebanon	82	2.72	53.2	Fiji	136	2.32	40.8
Lithuania	29	3.63	81.6	El Salvador	83	2.71	52.9	Libya	137	2.26	39.2
Qatar	30	3.60	80.6	Mozambique	84	2.68	52.2	Bolivia	138	2.25	38.8
Hungary	31	3.43	75.3	Guyana	85	2.67	51.7	Angola	139	2.24	38.5
Malaysia	32	3.43	75.2	Morocco	86	2.67	51.6	Turkmenistan	140	2.21	37.6
Poland	33	3.43	75.2	Bangladesh	87	2.66	51.6	Armenia	141	2.21	37.4
Turkey	34	3.42	75.1	Ghana	88	2.66	51.5	Liberia	142	2.20	37.3
India	35	3.42	75.0	Costa Rica	89	2.65	51.1	Gabon	143	2.19	36.9
Portugal	36	3.41	74.7	Nigeria	90	2.63	50.5	Eritrea	144	2.17	36.3
New Zealand	37	3.39	74.0	Dominican Republic	91	2.63	50.4	Chad	145	2.16	36.1
Estonia	38	3.36	73.3	Togo	92	2.62	50.1	Kyrgyz Republic	146	2.16	35.8
Iceland	39	3.35	72.7	Moldova	93	2.61	50.0	Madagascar	147	2.15	35.8
Panama	40	3.34	72.5	Colombia	94	2.61	50.0	Cameroon	148	2.15	35.7
Slovak Republic	41	3.34	72.4	Côte d'Ivoire	95	2.60	49.7	Iraq	149	2.15	35.6
Kenya	42	3.33	72.3	Iran, Islamic Rep.	96	2.60	49.6	Afghanistan	150	2.14	35.4
Latvia	43	3.33	72.1	Bosnia and Herzegovina	97	2.60	49.5	Zimbabwe	151	2.08	33.6
Bahrain	44	3.31	71.7	Comoros	98	2.58	49.0	Lao PDR	152	2.07	33.1
Thailand	45	3.26	69.9	Russian Federation	99	2.57	48.7	Tajikistan	153	2.06	32.9
Chile	46	3.25	69.7	Niger	100	2.56	48.4	Lesotho	154	2.03	31.8
Greece	47	3.24	69.4	Paraguay	101	2.56	48.4	Sierra Leone	155	2.03	31.8
Oman	48	3.23	69.3	Nicaragua	102	2.53	47.5	Equatorial Guinea	156	1.88	27.3
Egypt, Arab Rep.	49	3.18	67.7	Sudan	103	2.53	47.4	Mauritania	157	1.87	26.8
Slovenia	50	3.18	67.7	Maldives	104	2.51	46.9	Somalia	158	1.75	23.2
Croatia	51	3.16	67.0	Papua New Guinea	105	2.51	46.8	Haiti	159	1.72	22.2
Saudi Arabia	52	3.16	66.8	Macedonia, FYR	106	2.51	46.8	Syrian Arab Republic	160	1.60	18.5
Kuwait	53	3.15	66.7	Burundi	107	2.51	46.8				
Mexico	54	3.11	65.5	Mongolia	108	2.51	46.7				

Summary and key findings

Logistics performance both in international trade and domestically is central to the economic growth and competitiveness of countries, and the logistics sector is now recognized as one of the core pillars of economic development. Policy makers not only in the best performing countries, but also in emerging economies, increasingly see the need to implement coherent and consistent policies to foster seamless and sustainable supply chain operations as an engine of growth.

Efficient logistics connects firms to domestic and international markets through reliable supply chain networks. Conversely, countries characterized by low logistics performance face high costs, not merely because of transportation costs but also because of unreliable supply chains, a major handicap in integrating and competing in global value chains. Supply chains are complex, but their performance is largely dependent on country characteristics, especially the soft and hard infrastructure and institutions that logistics requires to operate well, such as imports, regulations, procedures, and behaviors.

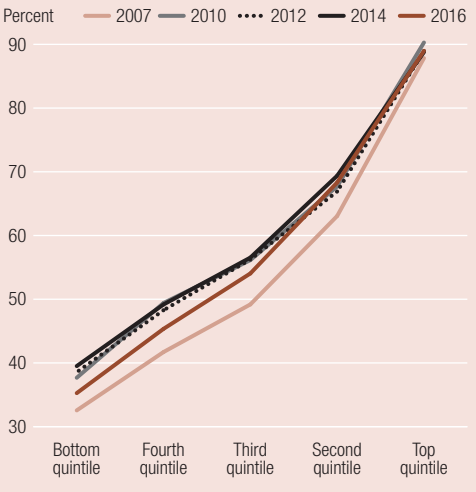
Now in its fifth edition, the Logistics Performance Index (LPI) embodies the experience of logistics professionals worldwide and tries to capture the complexity of supply chains in synthetic indicators that are comparable across countries. The LPI has provided valuable information for policy makers, traders, and other stakeholders, including researchers and academics, on the role of logistics for growth and the policies needed to support logistics in areas such as infrastructure planning, service provision, and crossborder trade and transport facilitation.

Logistics performance converges at the top, but the gap is widening between the worst and best performers

The results of *Connecting to Compete 2016* point to Germany as the best performing country, with an LPI score of 4.23, and Syria as the lowest, with a score of 1.60 (equivalent to 19 percent of Germany's score on a scale from 1 to 5). The converging trend between the top and worst performers that appeared in the previous LPI surveys (2007, 2010, 2012, and 2014) seems to have slightly reversed. The average scores in each quintile reveal that the gap between the top 2 quintiles and the countries at the bottom in performance is widening again (figure 1).

The modest convergence since 2007 was explained in the 2014 report by a perceived

Figure 1 **LPI score as percentage of highest LPI score, by LPI quintile averages, 2007, 2010, 2012, 2014, and 2016**



Source: Logistics Performance Index 2007, 2010, 2012, 2014, and 2016.

improvement in trade-supporting infrastructure in low- and middle-income countries and, to less extent, in their logistics services and their customs and border management. This explanation may still be largely valid in the majority of ranked countries. In 2016, however, the widening of the gap between the top and the bottom was amplified by the highest average scores ever among the top countries (4.13 in 2016) and the lowest average scores among countries at the bottom since 2007 (1.84 in 2007; 1.91 in 2016) (table 1).

The differing pace of progress is also seen in the ratings on the quality of domestic trade and transport infrastructure. In the domestic section of the LPI questionnaire, respondents were asked to assess the extent of improvements in these areas since 2014. While about 60 percent of the respondents in the top 2 quintiles rated the situation in 2016 as improved or much improved, only about a third in the bottom quintile and fewer than half in the third and fourth quintiles shared this view.

Logistics performance captures more than income, as observed since the first LPI report in 2007. International supply chains are organized across groups of regional trading countries. Provisions for services and trade facilitation initiatives are designed and implemented regionally. Reflecting on these mechanisms, the LPI data show that performance is quite consistent within integrated subregions. For instance, Western and Central Africa shows lower performance than Southern Africa or than East Africa, which has engaged in significant improvement in trade corridor efficiency. North African and Middle Eastern developing countries are doing comparatively worse than their income level would indicate, due to lack of integration, political unrest, and security challenges. In South Asia, lack of integration means that the good logistics performance of India does not improve that of its neighbors. Meanwhile, East Asian economies have performed consistently well across LPI editions.

Supply chain reliability and service quality are key objectives across all performance groups

Logistics firms have a strong incentive to provide predictable deliveries in both the developed and the developing world. Supply chain reliability continues to be a major concern among traders and logistics providers. In a global environment, consignees require a high degree of certainty on when and how deliveries will take place. This is much more important than the speed of the delivery. Predictability also carries a premium, which many shippers are willing to pay. In other words, supply chain predictability is a matter not merely of time and cost, but also of shipment quality. In the top LPI quintile, only 13 percent of shipments fail to meet company quality criteria, the same proportion as in 2014. By comparison, nearly three times more shipments in the bottom quintile (over 35 percent) fail to meet company quality criteria. This finding again illustrates that, in supply chain efficiency and reliability, the logistics gap is real and persistent.

Infrastructure development continues to accomplish much in assuring basic connectivity and access to gateways for most developing countries. This has also been consistently observed in the LPI since 2007. The perceived quality of certain types of infrastructure also seems to follow a similar pattern across all LPI editions. The quality of information and communications technology (ICT) infrastructure is again rated highest across all respondents, and here the gap between lowest and highest

Table 1 **Top 10 average and bottom 10 average LPI scores, 2007–16**

Indicator	2007	2010	2012	2014	2016
Top 10 average	4.06	4.01	4.01	3.99	4.13
Bottom 10 average	1.84	2.06	2.00	2.06	1.91

Source: Logistics Performance Index 2007, 2010, 2012, 2014, and 2016.

performers is narrowing the most. By contrast, satisfaction with rail infrastructure remains low. The widest gap in satisfaction is with warehousing and transloading infrastructure: while 65 percent of the respondents in the top LPI quintile regarded the quality of these as high or very high, only 13 percent in the bottom quintile had the same view. Ratings on other types of infrastructure vary by region.

Trade logistics services are provided under different environments globally. As in 2014, we see that the quality of services provided by logistics firms is often perceived as better than the quality of the corresponding infrastructure the firms operate. This may partly be explained by the respondent base, that is, freight forwarders and logistics firms rating their own services. Nonetheless, the pattern that emerges from responses across LPI editions is rather uniform: the more international operations, such as air and maritime transport and services, tend to receive high scores even if infrastructure bottlenecks exist. Railroads, meanwhile, continue to show low ratings almost everywhere. Low-income countries still score poorly on road freight services.

Service quality differs substantially at similar levels of perceived infrastructure quality. This indicates that even high-quality hard infrastructure cannot substitute or replace operational excellence, which is based on the professional skills of service providers, well-functioning soft infrastructure, and smooth business and administrative processes. This is explored in section 3.

Trade and transport facilitation is critical for lower performers

Efficient clearance procedures at the border are critical to eliminating avoidable delays and to improving supply chain predictability. To achieve this, governments need to facilitate trade, while safeguarding the public against harmful activities ranging from health hazards to crime and terrorism. Realizing these two objectives—facilitating trade and safeguarding the public interest—is a challenge for policy makers and authorities, especially in countries with a low performance record, where delays and unexpected costs are more common. As in previous editions, this edition finds that border clearance times tend to be longer in countries with less friendly logistics environments.

The 2016 results (section 2) imply that trade facilitation tools and principles have taken hold in many countries thanks to growing awareness and international initiatives to support trade facilitation reforms in developing countries. Coordination among government control agencies continues to require attention, including the need to introduce best practices in automation (for example, single windows) and risk management in non–customs control agencies, which have been less open to reform. Accordingly, customs agencies have again obtained much higher LPI ratings than the other agencies rated in the domestic part of the LPI, such as sanitary and phytosanitary control agencies and those enforcing the quality or technical standards of goods.

Yet, the implementation of trade and transport reform is lagging in the logistically constrained countries that are most in need of attention from the international community. Moreover, their neighbors also often face serious governance challenges (for example, conflict-ridden or postconflict countries and fragile states). Many landlocked developing countries and small island states also fall into this category because their connectivity with global markets may be severely challenged by their economic size or geography. Long overdue and still mostly unresolved implementation challenges, such as troubled regional transit regimes, seriously hamper these countries. The realization of sensible facilitation policies remain key for future progress given that many now have a basic connective infrastructure.

Relatively rapid improvements can also be achieved regionally if countries have a strong political will and align their efforts in implementing administrative reform. This is the case, for example, of the Northern Corridor that links Burundi, Rwanda, and Uganda with the port of Mombasa in Kenya and also serves eastern parts of the Democratic Republic of Congo, South Sudan, and Tanzania (see section 3). Some of

the soft trade and transport facilitation reforms with a significant impact were implemented even before hard infrastructure projects were completed. The soft reforms provided a greater, more rapid return on investment relative to hard infrastructure.

Logistics friendlier countries face complexity, new policy concerns, and competitive pressure

The LPI results since 2007 have shown that higher service quality is driving logistics performance in emerging and richer economies. Yet, the development of services, as in third- or fourth-party logistics, is a rather complex policy agenda not least because the provision of these more advanced services cannot be created from scratch or developed purely domestically. In logistics-friendly countries, manufacturers and traders already outsource much of their basic transport and logistics operations to third-party providers and focus on their core business, while managing more complex supply chains. The more such advanced services are available at a reasonable price-cost ratio, the more shippers will outsource their logistics. The current environment for international trade—structurally slower growth patterns relative to before the 2008–09 financial crisis—puts a lot of pressure on the industry, which is also pushing for quality and innovation.

The 2016 survey confirms that the policy agenda is becoming more complex. The demand for environmentally friendly logistics solutions, or green logistics, is gradually becoming a common feature in most advanced logistics environments (section 3). Two-fifths of survey respondents acknowledge this is a major concern in the top performance quintile. The 2016 survey introduced a new set of questions on skills and the logistics labor force. The results highlight a shortage of skilled labor, though there are differences across countries and job profiles.

There is thus an expanding need for consistent strategies that cut across the numerous policy dimensions, especially in high- and middle-income countries. Policy makers in large emerging or developed economies have to deal not so much with border issues, such as in low performance countries, but with the internal performance of domestic supply chains (a reality not well captured in the main LPI index). Comprehensive strategies increasingly focus not merely on looking at the sources of costs, but on steering a sector with a large footprint in the economy and with links to concerns about the environment, jobs, land use, urban planning, and other issues.

A growing number of countries follow this route, which is rarely easy. The implementation of reforms involving many stakeholders can be slow. Except in low performing countries, short-term, high-impact interventions (the low hanging fruits) are likely to have already been implemented. Countries successful in introducing far-reaching changes have been those combining regulatory reform with investment planning, interagency coordination, and incentives for operators. Detailed, accurate data are needed for policy making and monitoring. The growing availability of large datasets or even big data is a new opportunity that so far is being seized only by a few countries, such as Canada and South Africa.

* * *

Logistics performance depends on the availability to traders of reliable supply chains and predictable service delivery. Global supply chains are becoming more complex, and the safety, social, environmental, and other regulations affecting traders and operators are becoming more demanding. Efficient management and information technology (IT) solutions in both the private and public sectors are vital tools of the trade in high-quality logistics. The ability to manage logistics processes in today's global business environment is a crucial factor in national competitiveness.

More than ever, comprehensive reform and long-term commitments from policy makers and private stakeholders are needed. The current edition of the LPI provides a unique and updated reference base to understand key logistics impediments worldwide and to enable well-informed policy making and business decisions.

SECTION 1

The 2016 Logistics Performance Index

Introduction

> *France is among the highest performing economies in terms of logistics. This is a determining factor of our competitiveness. It represents 10 percent of national GDP, 200 billion euro turnover, and 1.8 million jobs. Our country is particularly known for the quality of its workforce, its infrastructure network, its equipment, and the availability of land. But this position cannot be taken for granted, and France needs to further progress to become a world leader. Ranked only 13th in global logistics (LPI World Bank) behind its closest neighbors, logistics underperformance is costing our economy between 20 billion and 60 billion euro.*
>
> Communiqué of the French Government March 2016[1]

This quote is just one recent example of a major economy viewing logistics as a policy concern and developing a comprehensive approach involving public agencies and the private sector. It follows the experience of many other advanced economies (for example, Canada, Finland, Germany, and the Netherlands) and emerging and developing economies such as China, Indonesia, Mexico, Morocco, South Africa, Thailand, and Turkey.

Logistics refers to a series of services and activities, such as transportation, warehousing, and brokerage, that help to move goods and establish supply chains across and within borders. Although these services and activities are carried out by private firms for the benefit of private firms, service delivery and the efficiency of supply chains depend on public sector provisions and interventions in a number of domains. Logistics uses publicly funded or regulated infrastructure. International trade is processed by border agencies. Services and logistics activities are regulated with fiscal, environmental, safety, land use, and competition objectives. Since the first edition of this report, in 2007, it has become widely recognized that these attributes are captured in the concept of logistics performance. Logistics performance varies across economies and is influenced by policies.

The quote from France also encapsulates the two main objectives of current logistics strategies in all types of economies. First, logistics is an input to much of the economy, that is, industry, commerce, and so on. The performance of logistics impacts productivity in other sectors. This is most often presented in negative language in terms of average costs of logistics. Furthermore, logistics can be a sector of development in and of itself, where countries with high global or regional connectivity expect to play the role of a logistics and trade hub, such as the Netherlands in Europe and Dubai or Singapore in Asia.

Benchmarking indicators such as the Logistics Performance Index (LPI) play a role in informing the trend in logistics-related reforms. Synthetic indicators may not do justice to the complexity and variety of operations in supply chains and may emphasize certain activities at the expense of others. The LPI itself for instance was designed to look at the border component of supply chains, as trade and transport facilitation was the priority reform area when the index was created in 2007. Despite some improvements of the LPI to capture domestic concerns such as environmental sustainability or labor and skill shortages, the LPI is less suitable for gauging the performance of domestic logistics.

This report is organized in three sections. The first one introduces the LPI and its main index and trends across countries. Section 2 unbundles the patterns of domestic policies and endowments and shows how performance varies across a number of dimensions. The third and final section looks at implementation and emerging policy challenges.

Features of the 2016 survey

The 2016 LPI survey follows the same methodology as the previous four editions of *Connecting to Compete*: a standardized questionnaire with two parts, international and domestic. In the international questionnaire, respondents evaluate six core pillars of logistics performance in up to eight of their main overseas partner countries (box 1.1). In the domestic questionnaire, respondents are asked to provide qualitative and quantitative data on the logistics environment in the country in which they work.

In 2016, more than 7,000 country assessments were made by logistics professionals, in line with the past two editions (box 1.2). Moreover, this edition covers 160 countries in the international LPI, whereas the domestic LPI covers more than 125 countries. This year's survey attempts to capture new trends in logistics practices worldwide, such as insights into logistics skills and the challenges in recruiting qualified staff for the industry. As in previous versions of the report, this edition includes a question on the extent of demand for environmentally friendly logistics solutions.

Box 1.1 Using the LPI

The World Bank's LPI analyzes countries in six components:

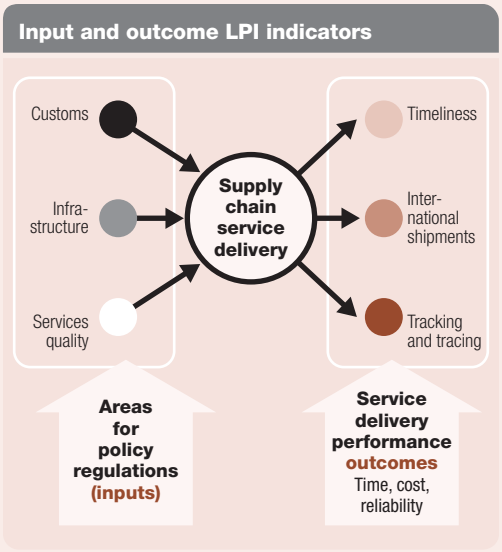
- The efficiency of customs and border management clearance
- The quality of trade and transport infrastructure
- The ease of arranging competitively priced shipments
- The competence and quality of logistics services
- The ability to track and trace consignments
- The frequency with which shipments reach consignees within scheduled or expected delivery times

The components have been chosen based on theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding. The figure maps the six LPI indicators to two main categories:

- Areas for policy regulation, indicating main inputs to the supply chain (customs, infrastructure, and services)
- Supply chain performance outcomes (corresponding to LPI indicators of time and reliability: timeliness, international shipments, and tracking and tracing)

The LPI uses standard statistical techniques to aggregate the data into a single indicator.[a] (See appendix 5 for a detailed description of how the LPI is calculated.) This single indicator can be used to compare countries, regions, and income groups. It can also be used for country-level work.

Because operators on the ground can best assess the vital aspects of logistics performance, the LPI relies on a structured online survey of logistics professionals from the companies responsible for moving goods around the world: multinational freight forwarders and the main express carriers. Freight forwarders and express carriers are best positioned to assess how countries perform. And their views matter because thes operators directly affect the choice of shipping routes and gateways, thereby influencing the decisions of firms on production location, choice of suppliers, and selection of target markets. Their participation is central to the quality and credibility of the LPI, and their involvement and feedback have been essential in developing and refining the survey in this fifth edition of the LPI. In 2016, 1,051 logistics professionals participated in the survey for the LPI.



See the 2016 LPI questionnaire at http://lpi.worldbank.org/.

a. In all five editions of the LPI (2007, 2010, 2012, 2014, and 2016), statistical aggregation has produced an overall index that is close to the simple average of country scores across the six LPI components.

Box 1.2 **How precise are LPI scores and ranks?**

Although the LPI and its components now offer the most comprehensive and comparable data on country logistics and trade facilitation environments, they have a limited domain of validity. First, the experience of international freight forwarders might not represent the broader logistics environment in poor countries, which often rely on traditional operators. International and traditional operators might differ in their interactions with government agencies and in their service levels. Most agents and affiliates of international networks in developing countries serve large companies and perform at different levels, including in time and cost, relative to traditional trading networks.

Second, for landlocked countries and small island states, the LPI might reflect access problems outside the country assessed, such as transit difficulties. The rating of a landlocked country, such as Lao PDR, might not adequately reflect local trade facilitation reform efforts, as these still depend on international transit routes mainly through Thailand and Vietnam.

To account for the sampling error created by the LPI's survey-based dataset, LPI scores are presented with approximate 80 percent confidence intervals (see appendix 5). These intervals yield upper and lower bounds for a country's LPI score and rank.[a] Confidence intervals must be examined carefully to determine whether a change in score or a difference between two scores is statistically significant. An improvement in a country's performance should be considered statistically significant only if the lower bound of the 2016 LPI score exceeds the upper bound of the 2014 score.

Because of the LPI's limited domain of validity and the need for confidence intervals to account for sampling error, a country's exact ranking might be less relevant to policy makers than its proximity to others in a wider performance group or its statistically significant improvements. Still, a close examination of the distribution of changes in ranking indicates that these behave similarly across all five editions of the index.

One should thus interpret especially the ranks and changes in ranks from one LPI edition to another with caution. In the aggregate data in the past four LPI surveys, 46 countries scored 70 percent or more of the top performer. For these countries, the average difference per rank position was 0.021 score points. For the next 53 countries scoring 50–69 percent of the top performer, the average difference per rank was only 0.011 score points. In the 40–49 percent range with 48 countries, the average difference per rank was a mere 0.006 score points. This means that countries at similar performance levels may have substantially different ranks, especially in the middle and lower range.

a. Upper bounds for LPI ranks are calculated by increasing a country's LPI score to its upper bound while maintaining all other country scores constant and then recalculating LPI ranks. An analogous procedure is adopted for lower bounds.

Key findings of the 2016 international LPI

Once more, high-income economies solidify their past performance by occupying the top 10 positions of the ranking in 2016 (table 1.1). This empirical regularity has been present in all editions of the LPI. In fact, the composition of the top 15 on the list of best performing countries has only changed marginally since 2014 and even 2010. This is not surprising. These countries have been traditionally recognized as dominant players in the supply chain industry, with a global footprint in transportation and logistics services provision.

The bottom 10 countries in the ranking are composed of low-income and lower-middle-income countries (table 1.2). Generally speaking, these are either fragile economies affected by armed conflict, natural disasters, and political unrest, or landlocked countries that are naturally challenged by economies of scale or geography in connecting to global supply chains.

The lower-middle-income group continues to be led by large economies such as India and Indonesia and emerging economies such as Kenya and Vietnam (table 1.3).

Meanwhile, the top-performing upper-middle-income economies show mixed performance, although the overall group composition remains similar to previous editions, with South Africa and China leading the group (table 1.4).

Within the low-income group, East African countries are leading the performance in this year's edition (table 1.5).

Figure 1.1 presents the cumulative distribution of LPI scores. The vertical lines represent the boundaries of LPI quintiles: five groups containing the same number of countries rated in the LPI. The bottom quintile includes countries with the lowest LPI scores, and the top quintile, those with the highest scores. As in the past, in the third and fourth quintiles, the range of scores is similar. This means that country LPI scores are closer to each other, and any alteration in the country's performance (and that of

Table 1.1 Top 10 LPI economies, 2016

Economy	LPI 2016 rank	LPI 2016 score	LPI 2014 rank	LPI 2014 score
Germany	1	4.23	1	4.12
Luxembourg	2	4.22	8	3.95
Sweden	3	4.20	6	3.96
Netherlands	4	4.19	2	4.05
Singapore	5	4.14	5	4.00
Belgium	6	4.11	3	4.04
Austria	7	4.10	22	3.65
United Kingdom	8	4.07	4	4.01
Hong Kong SAR, China	9	4.07	15	3.83
United States	10	3.99	9	3.92

Source: Logistics Performance Index 2014 and 2016.

Table 1.2 Bottom 10 LPI 2016 economies

Economy	LPI 2016 rank	LPI 2016 score	LPI 2014 rank	LPI 2014 score
Zimbabwe	151	2.08	137	2.34
Lao PDR	152	2.07	131	2.39
Tajikistan	153	2.06	114	2.53
Lesotho	154	2.03	133	2.37
Sierra Leone	155	2.03	na	na
Equatorial Guinea	156	1.88	136	2.35
Mauritania	157	1.87	148	2.23
Somalia	158	1.75	160	1.77
Haiti	159	1.72	144	2.27
Syrian Arab Republic	160	1.60	155	2.09

na is not applicable.
Source: Logistics Performance Index 2014 and 2016.

Table 1.3 Top-performing lower-middle-income economies

Economy	LPI 2016 rank	LPI 2016 score	LPI 2014 rank	LPI 2014 score
India	35	3.42	54	3.08
Kenya	42	3.33	74	2.81
Egypt, Arab Rep.	49	3.18	62	2.97
Indonesia	63	2.98	53	3.08
Vietnam	64	2.98	48	3.15
Pakistan	68	2.92	72	2.83
Philippines	71	2.86	57	3.00
Ukraine	80	2.74	61	2.98
El Salvador	83	2.71	64	2.96
Guyana	85	2.67	124	2.46

Source: Logistics Performance Index 2014 and 2016.

Table 1.4 **Top-performing upper-middle-income economies**

Economy	LPI 2016 rank	LPI 2016 score	LPI 2014 rank	LPI 2014 score
South Africa	20	3.78	34	3.43
China	27	3.66	28	3.53
Malaysia	32	3.43	25	3.59
Turkey	34	3.42	30	3.50
Panama	40	3.34	45	3.19
Thailand	45	3.26	35	3.43
Mexico	54	3.11	50	3.13
Brazil	55	3.09	65	2.94
Botswana	57	3.05	120	2.49
Romania	60	2.99	40	3.26

Source: Logistics Performance Index 2014 and 2016.

Table 1.5 **Top-performing low-income economies**

Economy	LPI 2016 rank	LPI 2016 score	LPI 2014 rank	LPI 2014 score
Uganda	58	3.04	na	na
Tanzania	61	2.99	138	2.33
Rwanda	62	2.99	80	2.76
Cambodia	73	2.80	83	2.74
Burkina Faso	81	2.73	98	2.64
Mozambique	84	2.68	147	2.23
Togo	92	2.62	139	2.32
Comoros	98	2.58	128	2.40
Niger	100	2.56	130	2.39
Burundi	107	2.51	107	2.57

na is not applicable.
Source: Logistics Performance Index 2014 and 2016.

its neighbors) generates larger changes in the ranking relative to those countries in other quintiles (box 1.3).

As in past LPI reports, LPI scores are broken down into four categories, consistent with the score quintiles, used in all editions of *Connecting to Compete*, as follows:

- *Logistics-unfriendly*: includes countries with severe logistics constraints, such as the least developed countries (bottom LPI quintile).
- *Partial performers*: includes countries with a level of logistics constraints most often seen in low- and middle-income countries (third and fourth LPI quintiles).
- *Consistent performers*: includes countries rated better on logistics performance than most others in their income group (second LPI quintile).
- *Logistics-friendly*: includes top performers, mostly high-income countries (top LPI quintile).

Logistics performance is rising, and performance is heterogeneous

With the fifth edition of the LPI, a number of trends observed in previous reports repeat themselves. There are still marked differences by component and quintile (figure 1.2). The performance of border agencies and infrastructure is the lowest among all quintiles, but especially so in the worst performing countries. On the

Figure 1.1 **Cumulative distribution of LPI scores**

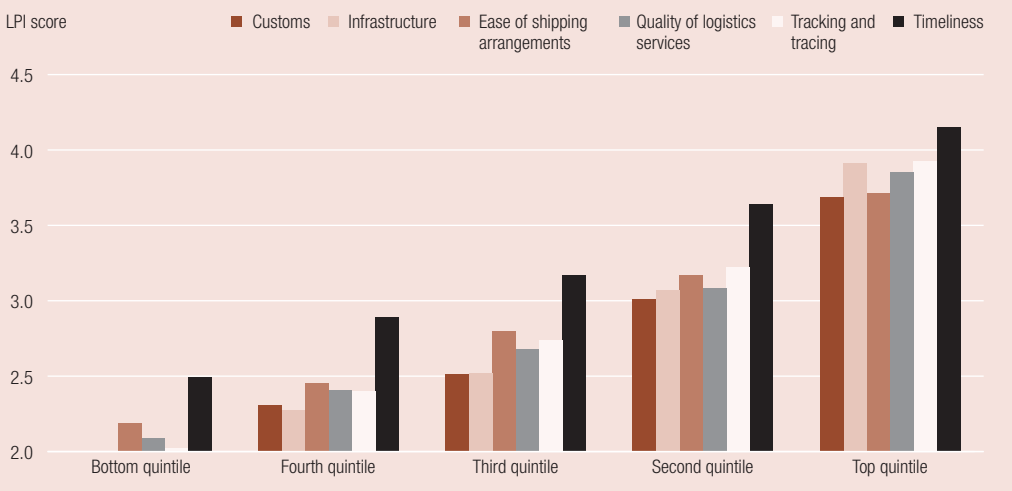
Source: Logistics Performance Index 2016.

other hand, the timeliness component seems to outperform the rest and is generally viewed by logistics professionals as the least problematic pillar. However, the difference is greatest again among countries that show a dismal overall score.

We have also examined which of the six components of the international LPI are above the overall index and which are below (table 1.6) as an indication of the performance of each pillar. A positive entry indicates that a component score is higher than a group's overall international LPI score and vice versa for a negative entry.

A number of features stand out. Customs and border agencies continue to underperform systematically in comparison with the other components of the LPI. Infrastructure exhibits a similar behavior as in previous occasions, with the highest quintile only showing a positive

Figure 1.2 **LPI component scores, by LPI quintile**



Source: Logistics Performance Index 2016.

Box 1.3 LPI results: Consistent within but not necessarily between regions?

As observed in previous editions of the report, logistics performance, as captured by the LPI, transcends the overall level of development and income. Geography matters, too. The crossborder nature of many logistics activities, such as trucking or freight forwarding, means that logistics performance is driven in part by subregional connectivity patterns. The performance of a regional gateway may diffuse across regional borders. As the example of East Africa shows (featured in this report), consistent improvement in integration and corridor performance benefits several countries.

The standard regional groupings (Sub-Saharan Africa, Eastern Europe and Central Asia) represent clear hemispheric blocs, yet are too large to reveal much about performance convergence or heterogeneity within and between subregions.

In an attempt to reach a finer attribution of performance, regions were subdivided as shown in the figure, and LPI score variance was decomposed in two: on one hand, the variance explained by variations in performance *within* subgroups and, on the other hand, variance explained by variability *between* subgroups. Overall, total variance in LPI scores can be explained majorly (64 percent) by variance across subregions.

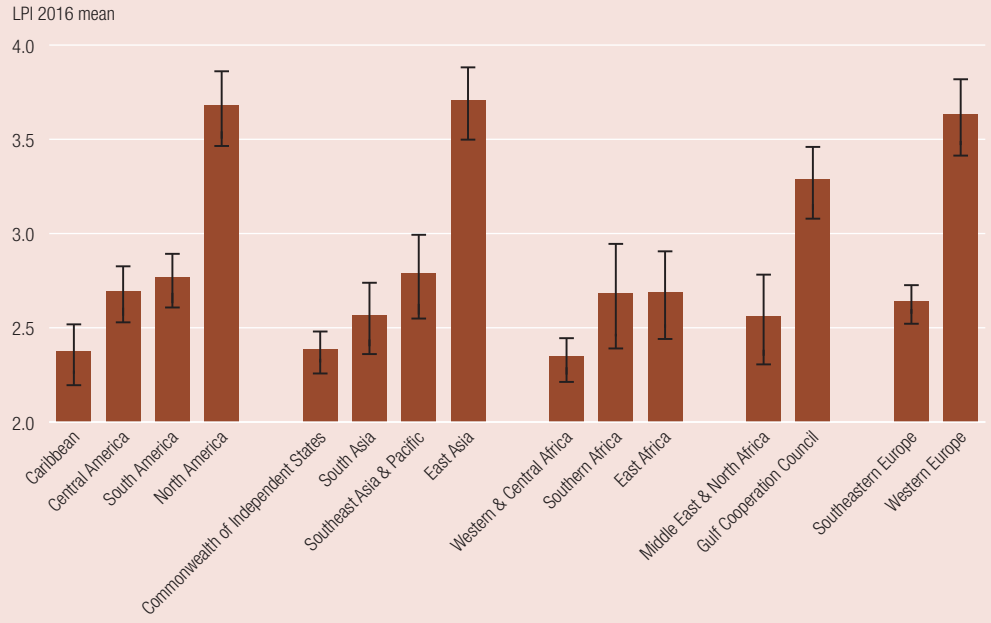
While this is an intuitive and expected result, it is also indicative of the coordinated movement in the rank that regional blocs can experience relative to neighboring subregions, and it shows that subregional convergence in scores merits further analysis. While certain positive regional developments could explain such performance premiums in specific parts of the world (for instance, elimination of border formalities within corridors), other, negative occurrences (such as armed conflict and political unrest) can present a contagion phenomena not easy to avoid.

Coastal access is another important enabler of logistics performance. In development economics generally and in trade and transport facilitation in particular, much attention has been paid to the disadvantaged position of low- and middle-income landlocked countries. Lack of access to the sea poses persistent challenges to the growth and development of landlocked developing countries and has been the main factor hindering their ability to better integrate with the global trading system. The transit of export and import goods through the territory of at least one neighboring state and frequent change of transport mode lead to high transaction costs and reduced international competitiveness. The issue of landlocked developing countries has also generated much policy work such as the 2003 Almaty Program of Action under the United Nations and the Vienna Program of Action 2014–24.[a]

The trade logistics handicap is illustrated by the average overall LPI scores for 2010–16 of landlocked and coastal countries across World Bank regions. This comparison shows a rather consistent pattern, where coastal countries score better than their landlocked peers at similar income levels. In the upper-middle-income group, this difference in Europe and Central Asia was 0.31 score points. The difference was even larger among lower-middle-income economies in South Asia (0.52 score points). In Sub-Saharan Africa, however, several landlocked countries performed better than coastal ones: by 0.20 points in the low-income group and by 0.14 points in the upper-middle-income group. Only Sub-Saharan African countries in the lower-middle-income group followed the familiar pattern, with a 0.20 point lead by coastal countries over landlocked countries. Among high-income countries of the Organisation for Economic Co-operation and Development (OECD), the difference between landlocked (3.69) and coastal countries (3.71) was almost insignificant (0.02 points) (see figure).

a. World Bank and UN-OHRLLS (2014).

LPI score means, by geographical region



Source: Logistics Performance Index 2016.

Table 1.6 **Deviation of each component from the overall LPI score, by quintile**

Percent

Quintile	Customs	Infrastructure	Ease of arranging international shipments	Quality of logistics services	Tracking and tracing	Timeliness
Bottom quintile	−0.13	−0.14	0.05	−0.05	−0.11	0.35
Fourth quintile	−0.15	−0.19	−0.01	−0.06	−0.06	0.43
Third quintile	−0.23	−0.22	0.06	−0.06	−0.01	0.42
Second quintile	−0.19	−0.13	−0.03	−0.12	0.02	0.44
Top quintile	−0.19	0.04	−0.16	−0.02	0.06	0.28

Note: All calculations are based on the weighted average score for the LPI and its components over 2007–14.
Source: Logistics Performance Index 2016.

markup compared with the overall score. Nonetheless, this time around, the quality of logistics services tends to be lower than the general performance across all quintiles. This was not the case for the highest performing countries in the past. Moreover, the tracking and tracing component also is lower than the overall score across all three lowest quintiles. Although this can be explained by a myriad of factors, a possible interpretation is that, during economic downturns, investments in technology are sometimes postponed. Another interpretation is that the requirements for tracking and tracing are more challenging than before, and today's technical solutions no longer meet the requirements.

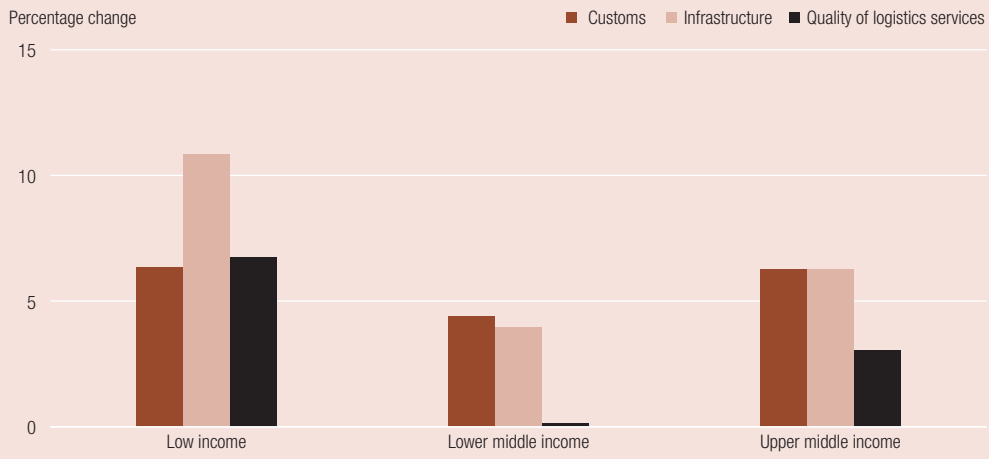
As observed from previous editions, average country LPI scores generally improve, although some factors and groups move faster than others. In low-income and lower-middle-income countries, average LPI scores have progressed the most rapidly in customs, infrastructure, and the quality of logistics services (figure 1.3).

Progress can be also tracked when asking respondents about the change in the environment for logistics since the last LPI edition. As in the past, survey respondents in better performing countries perceive more concrete improvements than in nonperforming economies (table 1.7). The contrast is the highest in absolute terms for all services (public and private) and infrastructure variables relative to regulations and governance variables.

Streamlining border clearance procedures and ensuring access to physical infrastructure will continue to be a priority for low-income economies. On the other hand, upper-middle-income countries have seemingly improved faster in the quality of logistics services, as in the previous 2014 edition. This continues to support the idea that middle-income countries have increasingly shifted their focus toward soft reforms and less so in physical infrastructure.

Still, a notable gap in LPI scores remains between high- and low-income countries (figure 1.4). High-income countries, on average, surpass low-income countries by 45 percent in terms of LPI scores. Moreover, among the

Figure 1.3 **Percentage change in LPI scores, customs, infrastructure, and quality of logistics services, 2014–16**



Source: Logistics Performance Index 2014 and 2016.

top 30 performing countries, 22 are members of the Organisation for Economic Co-operation and Development (OECD), almost unchanged since the 2014 report. Nonetheless, countries can still outperform their income group peers despite the performance gap. This is why income alone cannot explain why performance varies widely among countries in certain income groups. The list of countries overperforming their income group peers includes Kenya, Rwanda, and Uganda, but also China and India (figure 1.5). Conversely, the list of countries that fare below their potential for a given level of income includes most resource-rich economies such as Equatorial Guinea, Gabon, the Russian Federation, and Trinidad and Tobago.

For the first time in the history of the *Connecting to Compete* reports, landlocked countries are no longer automatically the most unfortunate ones, as evidenced by, for instance, the performance of Rwanda and Uganda. Despite the mentioned variations, caution should be exerted when interpreting LPI rankings.

Trends over the past four LPI editions

The gap in relative LPI scores—the scores expressed as a percentage of the leading country's score—is quite similar to the gap revealed in past years. Nonetheless, a relatively novel result is that the average relative score performance in the three lowest quintiles shows a small decrease compared with the last three LPI editions (figure 1.6).

Thus, in the past, the gap between the best and worst performing countries was smaller for countries with lower scores. In the 2016 edition, the relative lowest performer is the Syrian Arab Republic, with a score equal to 19 percent of the score of the highest performer (Germany). In 2014, the relative lowest performer was Somalia, with a score equal to 25 percent of the score of the highest performer.

The correlation between the 2014 and 2016 LPI scores is stronger than before, with 0.93 in scores, and 0.90 between ranks (whereas it was 0.91 and 0.86 between 2014 and 2012). One should keep in mind that, because the data are survey-based, sampling errors occur. Statistically significant changes are revealed only if the confidence intervals for the 2016 and 2014 scores do not overlap, which is only the case for the economies in table 1.8.

Following up on a feature introduced in the 2014 report, the scores of the six LPI components across the four latest surveys were used to provide a bigger, better balanced picture of country performance. This approach reduces the noise and random variation from one LPI survey to another and enhances the comparison of the 167 countries in the 2016 edition, one more than in the 2014 aggregation.

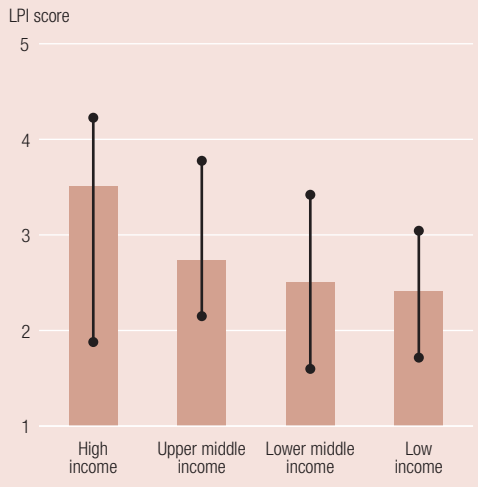
Table 1.7 Respondents reporting an improved or much improved logistics environment since 2012, by LPI quintile

Percent of respondents

Component	Bottom quintile	Fourth quintile	Third quintile	Second quintile	Top quintile
Customs	40	53	53	65	65
Other border procedures	31	37	40	54	60
Trade and transport infrastructure	34	48	50	60	60
ICT infrastructure	41	54	67	78	73
Private logistics services	39	63	61	76	65
Logistics regulation	19	35	39	47	35
Incidence of corruption	22	36	37	41	40

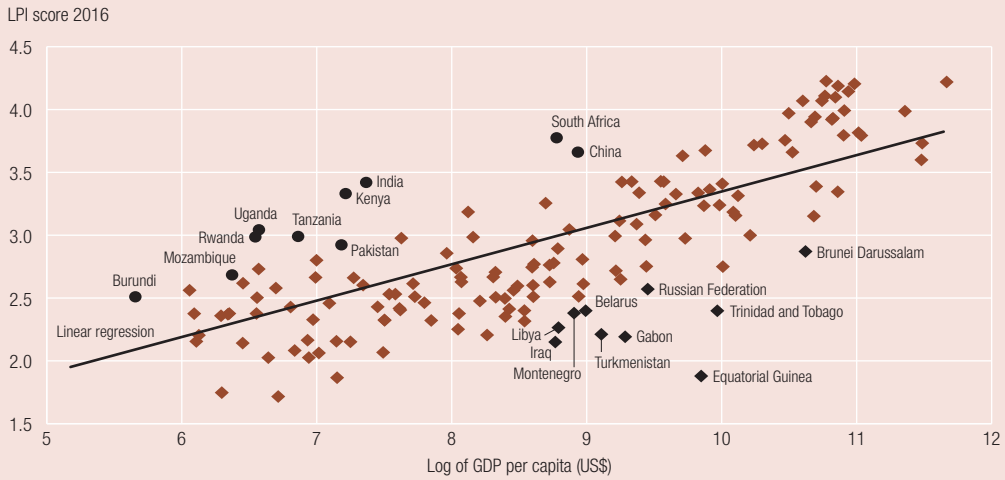
ICT is information and communications technology.
Source: Logistics Performance Index 2016.

Figure 1.4 Average LPI scores and minimum-maximum ranges, by income group



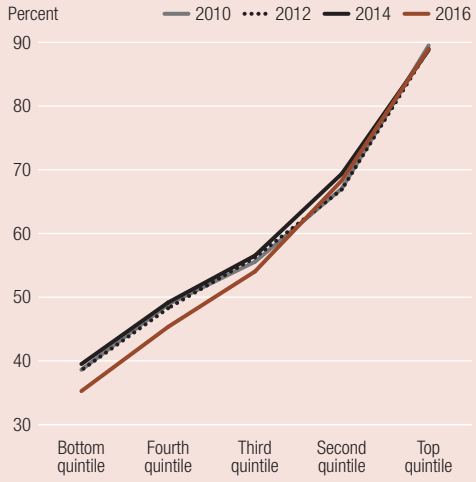
Note: Vertical rules show minimum-maximum range.
Source: Logistics Performance Index 2016.

Figure 1.5 LPI overperformers and underperformers



Note: Fitted values are based on an ordinary least squares regression using data for all countries. Underperformers (black diamonds) are the non–high-income countries with the 10 smallest residuals. Overperformers (black circles) are the non–high-income countries with the 10 largest residuals.
Source: Logistics Performance Index 2016.

Figure 1.6 LPI scores as a percentage of the best performer, LPI 2010–16



Source: Logistics Performance Index 2010, 2012, 2014, and 2016.

In this 2016 report, the four previous years' scores in each component were given weights: 6.7 percent for 2010, 13.3 percent for 2012, 26.7 percent for 2014, and 53.3 percent for 2016 (the most recent data carry the most weight; figure 1.7). The method is identical to the one in the 2014 report, which used the data for 2007, 2010, 2012, and 2014.

The possibility to use such weighted values is an important feature because an individual country's score and, consequently, also its rank can oscillate quite a lot, and the change will not be statistically significant. This also happened in several countries in 2014–16, especially those with a wide confidence interval in their scores, indicating more disagreement among the respondents. The impact tends to be amplified if the number of observations is low, as is often the case in smaller countries. Large traders, such as China, Germany, the United Kingdom, and the United States, had confidence intervals at 0.05 score points or below in the 2016 LPI, which is about 1 percent or less of their scores. By contrast, the Republic of Congo (confidence interval at 0.48), Morocco, and Lebanon (both at 0.41) had the largest confidence intervals in 2016, over 15 percent of their scores.

Also in this second aggregated 2010–16 LPI, Germany ranked highest at 4.17 (4.10 in the aggregated 2007–14 LPI), followed by the Netherlands 4.12 (4.05) and Singapore 4.10 (4.06). The top 3 countries are the same, even if the Netherlands and Singapore have traded places. Of the 28 European Union member states and the 34 OECD members, 14 and 22, respectively, were among the top 30 countries. The non-OECD economies in this group were Singapore (3rd); Hong Kong SAR, China (8th); United Arab Emirates (19th); Taiwan, China (23rd); South Africa (25th); China (26th); Qatar (29th; new among the top 30); and

Malaysia (30th). All but two of the top 30 were high-income countries; Malaysia and South Africa are upper-middle-income countries.

Also this time, all OECD countries were in the top third. The top third in the previous 2007–14 LPI included all European Union member states, but, now, two of them, Romania at 3.05 (ranked 56th) and Bulgaria at 2.96 (62nd), fall narrowly outside this category.

In the aggregated international LPI, Somalia again scores lowest at 1.67 (1.63 in the previous LPI), ranked 167th. Despite some convergence of countries' logistics performance since the 2007 LPI, the logistics gap between high- and low-income countries remains wide. As in previous LPI surveys, the countries with the weakest performance in 2016 were least developed countries, especially landlocked countries or small island states, some of them also conflict-ridden. This is vividly illustrated by the Syrian Arab Republic, which scored 2.31 and was ranked 148th of 166 countries in the 2007–14 LPI. Because of its low score and rank in the 2016 LPI, it now occupies the second-lowest rank, 166th, at 1.94 in the aggregated 2010–16 LPI.

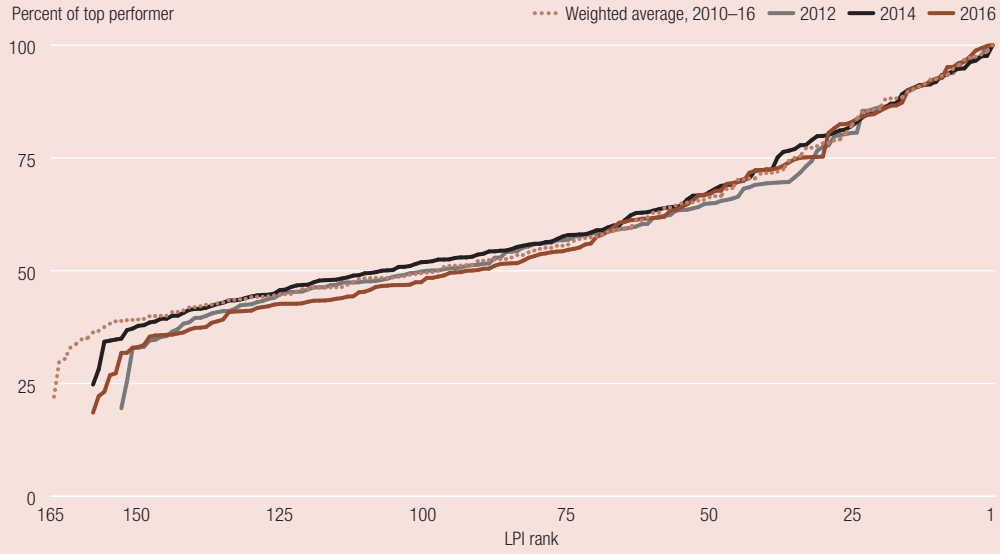
The convergence of performance—broadly, the range from rank 40 to 120—means this space is crowded with countries scores only separated by a few decimals (box 1.4). Thus, some large changes in rank might be witnessed in this middle ground, even if the underlying score changes are only marginal.

Table 1.8 Economies with statistically significant changes in LPI scores

Statistically significant change in LPI score, 2014–16	Low income	Lower middle income	Upper middle income	High income
Positive change	Tanzania Congo, Dem. Rep.	India Kenya	South Africa China	Germany Israel Austria Switzerland Hong Kong SAR, China Singapore United Arab Emirates Venezuela, RB
No change	135 countries			
Negative change	Haiti	Tajikistan	Malaysia Thailand	

Source: Logistics Performance Index 2014 and 2016.

Figure 1.7 Weighted aggregate international LPI scores, 2010–16



Source: Logistics Performance Index 2010, 2012, 2014, and 2016.

Box 1.4 Connectivity, logistics networks, and logistics performance

Since the first edition of *Connecting to Compete* in late 2007, many policy packages promoting gains in logistics, trade facilitation, and transport have been labeled as connectivity. The Asia-Pacific Economic Cooperation (APEC), for example, has a supply chain connectivity initiative, while Indonesia has set up a connectivity program, as has a group of countries in Central America and the Caribbean. Yet, despite the relevance and coherence of the policies, the concept remains intuitive and often loosely defined, such that connectivity may become a catchword with too blurry a relation to such practicalities as trade facilitation and logistics.

Some clarification and formalization of the concept have been proposed.[a] Trade logistics is supported by companies that operate in networks. International transportation, shipping, or air transport takes place in complex networks structured in hubs and spokes. The connectivity of a country, or perhaps one of its ports or airports, is defined as how central this country is to those networks. Connectivity partly reflects geography and the global structure of transportation and logistics networks. Country-specific trade transaction costs coming from supply chain inefficiencies increase economic distance and reduce connectivity. Hence, policies that increase logistics performance improve connectivity, notwithstanding network geography.

Of course, connectivity is not a purely exogenous concept. Instead, it is determined by a range of factors. One is market size: larger markets create more demand for international shipments; so, container lines, which operate on a network basis, are more likely for business reasons to make such countries more central in their schedules. It is therefore not only a country's policies and private sector development efforts that may promote connectivity. Larger countries typically have an advantage, and smaller ones have to exert more effort to attract international transport at low cost and sufficient regularity.

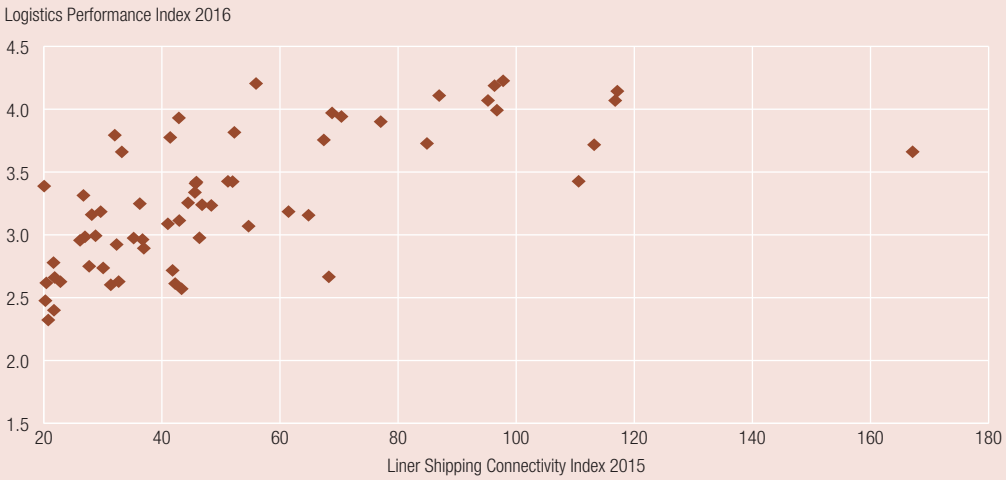
As one might expect, the LPI relates to other connectivity indicators, such as the Liner Container Shipping Connectivity Index (LSCI), published by UNCTAD. The figure below illustrates this correlation, but also confirms that the two indicators indeed capture tied but complementary dimensions in connectivity.

The point can also be made by taking an inverse approach, focusing on trade costs: trade costs are high in poorly connected peripheral countries and low in well-connected hubs. Research by the World Bank and the United Nations Economic and Social Commission for Asia and the Pacific on trade costs has shown that connectivity to maritime and air transport networks, along with logistics performance, are the main determinants of a country's overall level of trade costs.

An additional challenge that is not addressed by existing data is internal connectivity, particularly in large countries. The LPI measures performance at key international gateways in countries such as India and China, but does not address how easy or difficult it is to move goods to the hinterland. Yet such movements are important from developmental and equity standpoints. Internal trade costs likely remain high in many countries, and reducing them could make a significant difference to the lives of producers and consumers outside main cities.

a. Arvis and Shepherd (2011); Hoffmann and Ojala (2010).

The LPI and the Liner Shipping Connectivity Index



Source: Logistics Performance Index 2016.

SECTION 2

Unbundling logistics performance

The international LPI provides some preliminary information on the drivers of overall logistics performance. To unbundle the survey results further, however, it is necessary to refer to the domestic LPI. This section is based on the domestic LPI, where surveyed logistics professionals assess the logistics environments in the countries where they work. The domestic part thus contains more detailed information on countries' logistics environments and core logistics processes and institutions. This approach looks at the logistics constraints within countries, not merely at the gateways, such as ports or borders. It analyzes country performance in four major determinants of overall logistics performance: infrastructure, services, border procedures, and supply chain reliability.

Infrastructure

Survey respondents in top-quintile countries rated their infrastructure far more highly than others (table 2.1). Differences among the other four quintiles are less striking, especially for roads and rail. It is important to highlight that the spread of scores is narrowest in information and communications technology (ICT), which suggests that developing countries have been investing heavily in modern technologies, perhaps even leapfrogging intermediate levels in some cases. Of course, ICTs cannot replace other types of hard infrastructure, so a renewed focus on the other areas is needed.

Infrastructure, though still a constraint in developing countries, seems to be improving. Since the previous LPI survey, there is a general perception that infrastructure has improved in all performance quintiles (figure 2.1), but more so in the top-performing countries. If this perception reflects a faster rate of infrastructure improvement from an already strong base in those countries, it might indicate persistence of the logistics gap identified in previous editions. Of particular concern is the lower figure recorded in the bottom quintile, which would be consistent with a widening gap.

Satisfaction with infrastructure quality varies by infrastructure type. As in previous years, respondents in all LPI quintiles are most satisfied with ICT infrastructure. As in 2014, there is evidence of a narrowing infrastructure gap, particularly between the top and bottom quintiles where the rate of improvement seems noticeably more rapid than in the last version of this report; improvement in the middle quintiles is on a par with what has been observed previously. By contrast, but in line with previous reports, rail infrastructure inspires general dissatisfaction. In the bottom quintile, infrastructure generally fails to satisfy, an exception to the pattern of variation.

Similar patterns emerge when the domestic LPI data on infrastructure are disaggregated by World Bank region, excluding high-income countries (table 2.2). The highest ratings in all regions except East Asia and the Pacific are for ICT. Ratings for other types of infrastructure

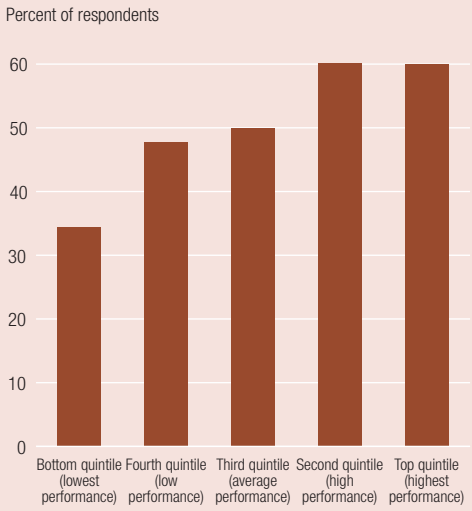
Table 2.1 **Respondents rating infrastructure quality high or very high, by infrastructure type and LPI quintile**

Percent of respondents

LPI quintile	Ports	Airports	Roads	Rail	Warehousing and transloading	ICT
Bottom quintile	19	21	17	14	13	27
Fourth quintile	18	28	13	15	19	33
Third quintile	31	35	16	14	27	39
Second quintile	35	32	24	7	31	60
Top quintile	63	66	59	36	65	76

ICT is information and communications technology.
Source: Logistics Performance Index 2016.

Figure 2.1 **Respondents rating trade and transport infrastructure quality improved or much improved since 2012, by LPI quintile**



Source: Logistics Performance Index 2016.

vary more widely by region, but two features stand out. First, satisfaction with road and rail infrastructure is especially low in Latin America and the Caribbean, as in 2014, but also in South Asia in this edition. Second, satisfaction with rail infrastructure is again low in all regions, as was the case for the analysis by LPI quintile.

Services

The quality and competence of core logistics service providers is another important part of overall country performance. For countries in all LPI quintiles, freight forwarders are rated highly, typically at or close to the strongest scores in this category (table 2.3).[2] Ratings for the other provider types vary more widely across all quintiles, though rail transport service provision, similar to rail infrastructure, consistently receives low ratings. And, as with infrastructure, countries in the top quintile receive by far the highest ratings for service provider quality and competence. Rail transport aside, service providers in all categories are rated highly in quality and competence in the top-performing countries, although the scores for consignees or shippers are lower than the scores for most other types of service provision.

Respondents in all LPI quintiles are nearly always more satisfied with service providers than with infrastructure quality (compare table 2.1 with table 2.3). But the difference is generally smaller in the top-performing countries. The contrast is particularly strong in the case of maritime transport in the second and third quintiles.

The performance gap between services and infrastructure appears generally across World Bank regions (table 2.4). It is particularly stark for air transport in South Asia and for maritime transport in East Asia and the Pacific, Europe and Central Asia, and South Asia. These data suggest a need to develop transport-related infrastructure so that positive reforms to service markets can bring maximum possible benefits to end users.

Table 2.2 **Respondents rating infrastructure quality high or very high, by infrastructure type and region**

Percent of respondents

Region	Ports	Airports	Roads	Rail	Warehousing and transloading	ICT
East Asia and Pacific	23	37	20	21	8	27
Europe and Central Asia	27	48	24	22	30	50
Latin America and Caribbean	21	22	12	3	15	34
Middle East and North Africa	33	35	24	20	31	36
South Asia	18	25	5	3	18	65
Sub-Saharan Africa	25	23	18	17	23	32

ICT is information and communications technology.
Source: Logistics Performance Index 2016.

Border procedures and time

The LPI includes several indicators of border procedures and time. Breakdowns of these data by region and income group are shown in appendix 2 and by time and cost and by country in appendix 3.

Import and export time

A useful outcome measure of logistics performance is the time taken to complete trade transactions. The median import lead time for port and airport supply chains, as measured for the LPI, is generally lower in better performing groups (figure 2.2): it takes around three times as long to import in the bottom quintile as in

Table 2.3 Respondents rating service quality and competence high or very high, by service type and LPI quintile

Percent of respondents

LPI quintile	Road transport	Rail transport	Air transport	Maritime transport and ports	Warehousing, transloading, and distribution	Freight forwarders	Customs brokers	Trade and transport associations	Consignees or shippers
Bottom quintile	17	6	30	36	16	34	17	19	31
Fourth quintile	23	13	36	33	22	41	30	18	29
Third quintile	26	15	50	53	41	54	40	28	33
Second quintile	37	18	48	54	41	56	40	29	28
Top quintile	66	40	75	68	74	80	79	62	49

Source: Logistics Performance Index 2016.

the top quintile.[3] This substantial gap is larger than the one observed in 2014 and closer to the 2012 numbers, which may indicate that trade facilitation reforms need to be approached with renewed vigor.

Importing in all LPI quintiles takes longer by land than by air or sea. The correlation between land distance and import lead time suggests that geographic hurdles, in addition to infrastructure, service provision, and other logistics issues, are important in determining a country's ability to connect with world markets.

Besides geography and speed en route, another factor in import lead times is the efficiency of border processes. Time can be reduced at all stages of this process, but especially in clearing goods on arrival (see figure 2.2). Countries with low logistics performance need to reform their border management so that they can cut red tape, excessive and opaque procedural requirements, and physical inspections. Although the time to clear goods through customs is a fairly small fraction of total import time for all LPI quintiles, it rises sharply if goods are physically

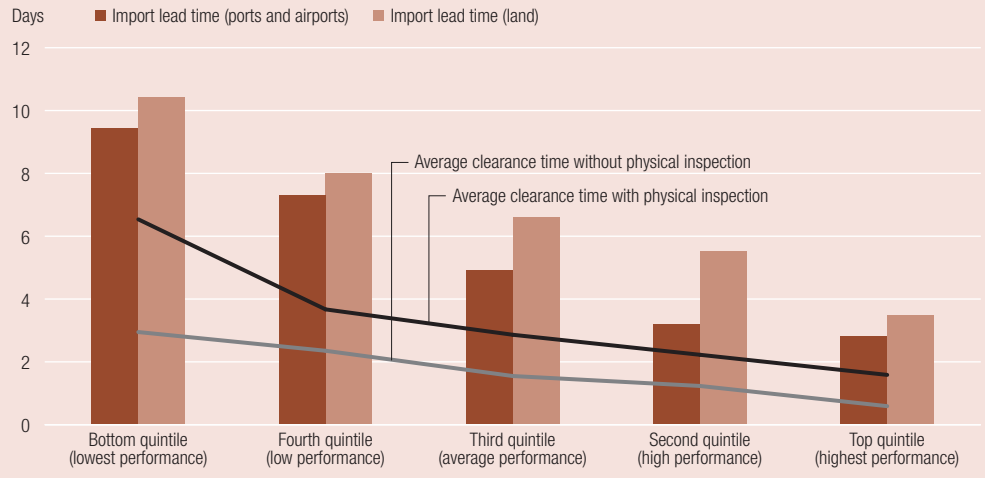
Table 2.4 Respondents rating services high or very high vs respondents rating infrastructure high or very high, by region

Difference in shares (percentage points)

Region	Maritime transport and ports	Air transport	Road transport	Rail transport	Warehousing, transloading, and distribution
East Asia and Pacific	25	13	7	0	16
Europe and Central Asia	28	5	11	–6	16
Latin America and Caribbean	12	9	5	1	19
Middle East and North Africa	10	0	9	–8	7
South Asia	33	31	11	1	8
Sub-Saharan Africa	17	17	3	–1	2

Source: Logistics Performance Index 2016.

Figure 2.2 Median import lead time and average clearance time, by LPI quintile



Source: Logistics Performance Index 2016.

inspected, even in top-performing countries. Core customs procedures are similar across quintiles. But low performing countries show a far higher prevalence of physical inspection, even subjecting the same shipment to repeated inspections by multiple agencies (table 2.5).

Export supply chains typically have a much lighter procedural burden than import supply chains, so lead times are shorter for exports than imports (figure 2.3). But export lead times display the familiar logistics gap: they are twice as long in low-income countries relative to high-income countries (figure 2.4). Moreover, export times for land supply chains differ much more between low-income countries and the rest than between middle- and high-income countries. Many low-income countries have long export lead times, hurting their export competitiveness and ability to trade internationally.

Unlike lead times, which vary considerably worldwide, customs procedures are becoming more similar (see table 2.5). Even the bottom-quintile countries tend to adopt core customs best practices. Even as customs procedures become gradually more similar, many countries still find their supply chain performance constrained by other border agencies, as customs is not the only agency in border management. Cooperation among all such agencies—standards; transport; veterinary; and health, sanitary, and phytosanitary—is critical to reform. So is

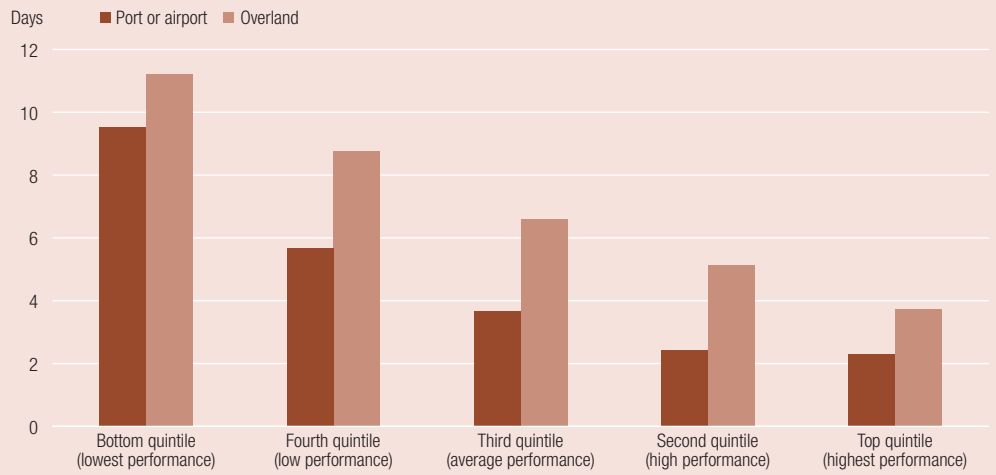
Table 2.5 Respondents indicating that listed customs procedures are available and being used, by LPI quintile

Percent of respondents, unless otherwise indicated

Customs procedure	Bottom quintile	Fourth quintile	Third quintile	Second quintile	Top quintile
Online processing of customs declaration	56	74	87	84	97
Requirement that a licensed customs broker be used for clearance	85	87	86	78	63
Choice of location of final clearance	67	70	65	76	74
Release with guarantee pending final clearance	65	58	55	63	60
Physical inspection of import shipments (percent of shipments)	27	26	21	21	5
Multiple physical inspections of import shipments	13	15	7	5	3

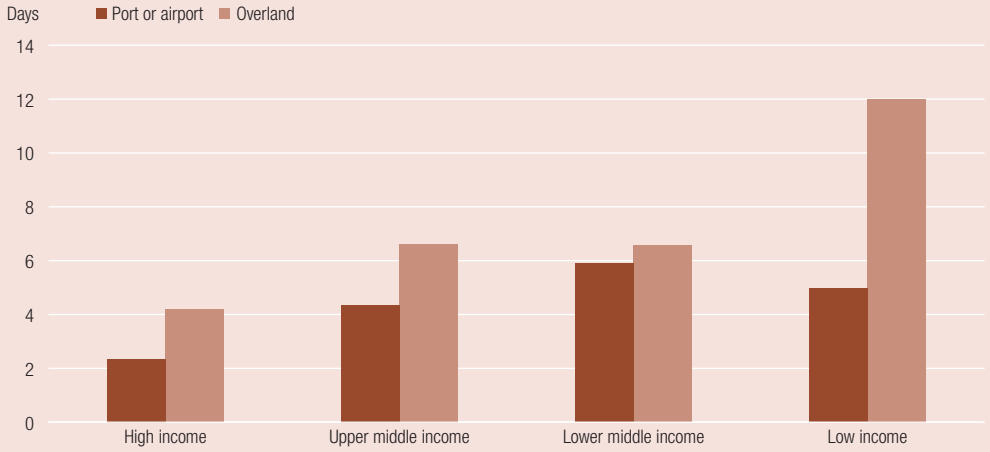
Source: Logistics Performance Index 2016.

Figure 2.3 Median export lead time, by LPI quintile



Source: Logistics Performance Index 2016.

Figure 2.4 **Median export lead time, by income group**



Source: Logistics Performance Index 2016.

introducing modern approaches to regulatory compliance.

Data for the 2016 LPI show that the performance gap between customs and other border agencies remains substantial (table 2.6). For many countries, the key to improving border agency performance may in fact lie with reforms to agencies other than customs. One reason for this difference between agencies is that fewer inspection procedures are required for products that are not perishable or time sensitive. Another is that health, sanitary, and phytosanitary agencies have been slow to automate.

A glance at table 2.6 and its equivalent for the 2014 LPI (*Connecting to Compete 2014,* table 2.6) shows that, whereas customs performance has likely improved in bottom-quintile countries, quality and standards/inspection agencies continue to represent a serious impediment to overall improvements in border agency performance.

Red tape

Indicators for red tape show the same lack of border coordination, with a resultant burden on private logistics operators. In countries in the bottom quintile, operators typically deal with around twice as many government agencies and documentary requirements as those in countries in the top quintile (figure 2.5). Countries in the top quintile typically require two supporting documents for trade transactions; those in the bottom, four or five, a persistent logistics gap revealed in the LPI.

Simplifying documentation for imports and exports has long been high on the trade facilitation agenda, prompting initiatives to

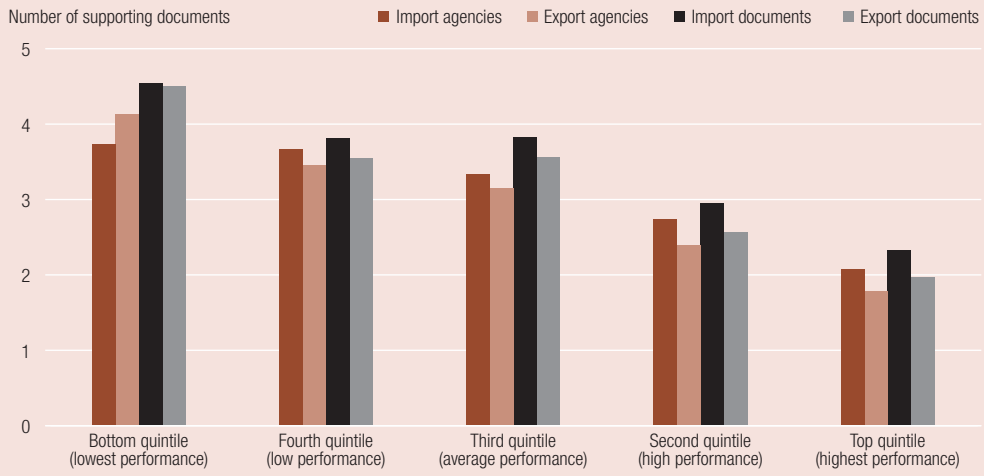
Table 2.6 **Three border agencies: respondents rating quality and competence high or very high, by LPI quintile**

Percent of respondents

LPI quintile	Customs agencies	Quality/standards inspection agencies	Health/sanitary and phytosanitary agencies
Bottom quintile	26	8	17
Fourth quintile	34	19	21
Third quintile	38	27	19
Second quintile	45	37	25
Top quintile	78	59	53

Source: Logistics Performance Index 2016.

Figure 2.5 **Red tape affecting import and export transactions, by LPI quintile**



Source: Logistics Performance Index 2016.

bring border agencies together and to create a single window for trade. The World Bank and International Finance Corporation's Doing Business indicators place great weight on such simplification. Still, also needed are steps in other aspects of border management and, more generally, soft and hard trade-related infrastructure.

International agreements such as the World Trade Organization (WTO) Agreement on Trade Facilitation contribute to stimulate reforms and improvement. First, they contribute to mutually agreed standards that the lowest performing countries can target. Further, they are subject to the WTO's binding trade disciplines, unlike previous conventions. The agreement also strengthens the delivery of technical assistance and capacity-building support for developing and least developed countries. Indeed, global experience suggests that many of the agreement's measures are relatively straightforward to implement, while others, such as introducing national Single Window systems, can be quite complex and will require sustained effort from governments. The results above suggest that the problems in meeting these standards as measured by the adherence to general customs principles (see table 2.5) in trade facilitation or the amount of red tape (see figure 2.5) are quite concentrated on the lowest performers.

Given the difficulties that some countries may face when implementing the new agreement, there are many caveats for developing and least developed countries, allowing much flexibility in timing and implementation. Initial indications are that some developing countries are being quite ambitious in scheduling obligations to fall into the agreement's category A, that is, applicable after entry into force or after a short transition period for least developed countries. However, not all countries have submitted notifications, so the exact extent to which the agreement is in fact implemented in the developing world is unclear.

Delays, reliability, and service delivery

Some causes of underperformance are endogenous to a country's supply chain: the quality of service and the costs and speed of clearance processes are examples. But other causes, such as dependence on indirect maritime routes, lie outside the domestic supply chain and are not under a country's control.

The LPI details possible causes of delay that are not directly related to how domestic services and agencies perform (table 2.7). There is, again, a striking contrast between the top and bottom LPI quintile countries. This contrast is especially large in three areas: informal (corrupt) payments, compulsory warehousing, and preshipment inspection. The first two overlap

Table 2.7 **Respondents reporting that shipments are often or nearly always delayed, by delay category and LPI quintile**

Percent of respondents

LPI quintile	Compulsory warehousing	Preshipment inspection	Maritime transshipment	Theft	Informal payments
Bottom quintile	51	32	25	8	24
Fourth quintile	21	22	38	16	21
Third quintile	19	20	15	13	33
Second quintile	15	20	10	12	12
Top quintile	4	6	8	3	4

Source: Logistics Performance Index 2016.

with the problems identified in previous editions, so it will be important to look closely at the data on delays due to preshipment inspection in future years to see whether that factor continues to stand out as a particular source of difficulties in low performing countries.

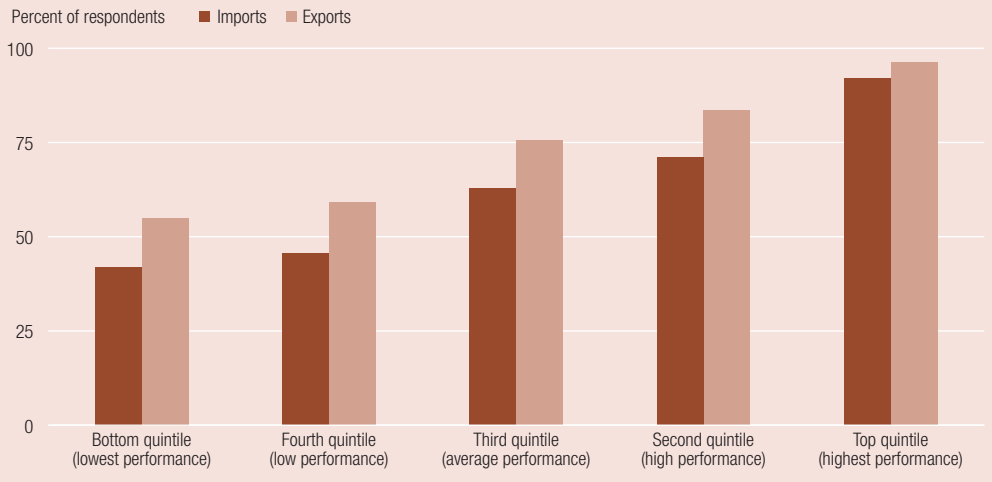
Delays and unexpected costs are common in bottom-quintile countries, undermining overall supply chain performance. Worse, the incidence of delays is increasing across LPI quintiles, especially in the lower reaches. However, bottom-quintile countries report significantly reduced levels of delay from theft and informal payments in this edition of the LPI relative to 2014. Sampling error may play a role, but this development is potentially positive for supply chain reliability in poorly performing countries. It will be important to reexamine the data in future years to see if the change is borne out. Nonetheless, the general pattern suggests that supply chain predictability is an acute commercial problem, particularly in the most poorly performing countries. The gap between the bottom and fourth quintiles in areas such as compulsory warehousing and preshipment inspection is notable, suggesting that it may be possible to improve performance with relatively modest policy interventions.

Predictable, reliable supply chains are central to good logistics performance. Indeed, highly variable lead times can disrupt production and exporting, forcing firms to adopt costly strategies such as express shipments or sharply higher inventories, which, because of global and regional value chains that rely on just-in-time production, can sharply erode competitiveness. Although firms can adopt other strategies, such as building in redundancies to deal with disruptions affecting one supplier, global market forces are such that providing the conditions for predictable, reliable supply chains have become imperative for countries that want their firms to join and move up in global and regional value chains.

An additional reason for policy makers to focus greater attention on supply chain reliability and predictability is the emerging networked structure of global and regional trade, which is linked in part to the rise of value chains. In a network, small disruptions at one point can spread rapidly and sometimes unpredictably to other points. The efficiency gains associated with networked production models thus come with increased systemic risk in the sense that the structure itself can be vulnerable to small shocks affecting crucial links. The upshot is that countries unable to provide the conditions for developing predictable and reliable supply chains will become increasingly disconnected from world markets where networked production models are common. Poorly performing countries need greater policy attention to improve their connectivity and to stem any further marginalization from the global trading system.

Supply chain reliability and predictability are further reflected in a key performance metric highlighted in the domestic LPI, namely, the timeliness of clearance and delivery (figure 2.6). Given that the frequency of delays rises sharply with declining logistics performance, it is unsurprising that the timeliness of clearance and delivery generally suffers as one

Figure 2.6 **Respondents reporting shipments often or nearly always cleared and delivered as scheduled, by LPI quintile**



Source: Logistics Performance Index 2016.

moves down the LPI quintiles. Thus, a stark difference in on schedule arrival rates separates countries at the bottom and top of the LPI ranking. In the top quintile, most respondents report that import and export shipments always or nearly always arrive on schedule; in the bottom quintile, only around half as many do so. Performance in both cases is similar in the 2014 LPI, with potentially a slight improvement in the case of the top quintile. This finding highlights the importance of steps to improve the predictability and reliability of supply chains in poorly performing countries to avoid widening in this element of the logistics gap (box 2.1).

The bottom two LPI quintiles show the largest difference between on schedule arrival rates for exports and those for imports (see figure 2.6), as in the previous edition. The much lower percentage of high ratings for imports suggests that supply chain unreliability discriminates in practice (if not in law) against foreign goods. As traditional trade barriers continue to fall around the world, policies contributing to such de facto discrimination become ever larger determinants of performance and trade outcomes. Addressing the causes of unexpected delays, including unpredictability in clearance, inland transit delays, and low service reliability, should thus be an important part of logistics reform in poorly performing countries.

The patterns highlighted above are more striking in some World Bank regions than others (figure 2.7). Beyond the export-import performance gap, these data show a geographic predictability gap, with implications for competitiveness and the spread of regional supply chains and production networks. However, it is important to approach figure 2.7 with some degree of caution, as data vary considerably from one year to another, in part due to differences in response patterns across countries.

Supply chain predictability is not only a matter of time and cost. A further consideration for private sector operators and their clients is shipment quality, which varies widely in the 2016 LPI (figure 2.8). In the top LPI quintile, only 13 percent of shipments fail to meet company quality criteria, the same proportion as in 2014. By comparison, nearly three times as many shipments in the bottom quintile fail to meet company quality criteria. This finding again illustrates that, in supply chain efficiency and reliability, the logistics gap is real and persistent

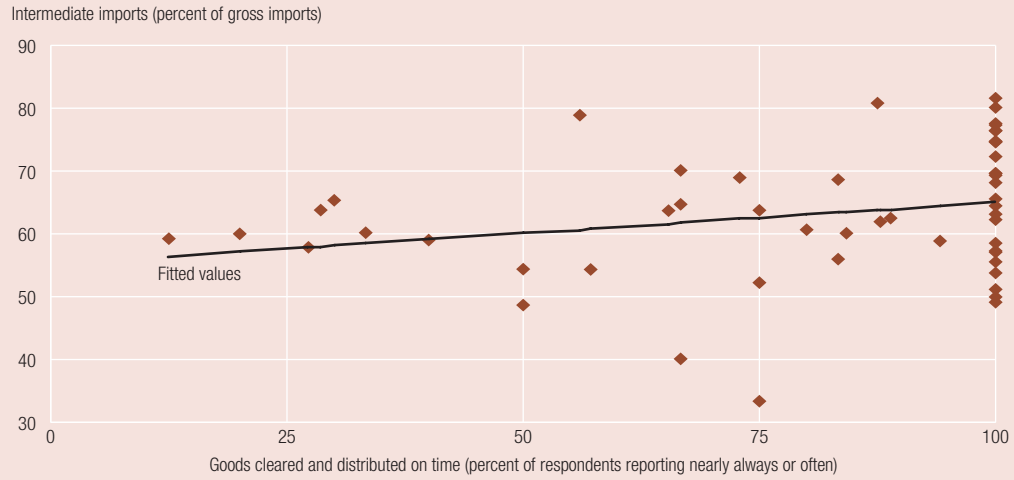
The most important quality criterion in freight forwarding is delivery within the promised time window. Almost as important is the absence of errors in cargo composition or

Box 2.1 Timeliness and global value chains

As indicated in the main text, reliability and timeliness are key considerations for firms involved in global value chains. Indeed, the ability to ensure on-time delivery and clearance—as reflected in the data summarized in figure 2.6—is an important way in which countries can attract lead firms in global value chains to make investments there.

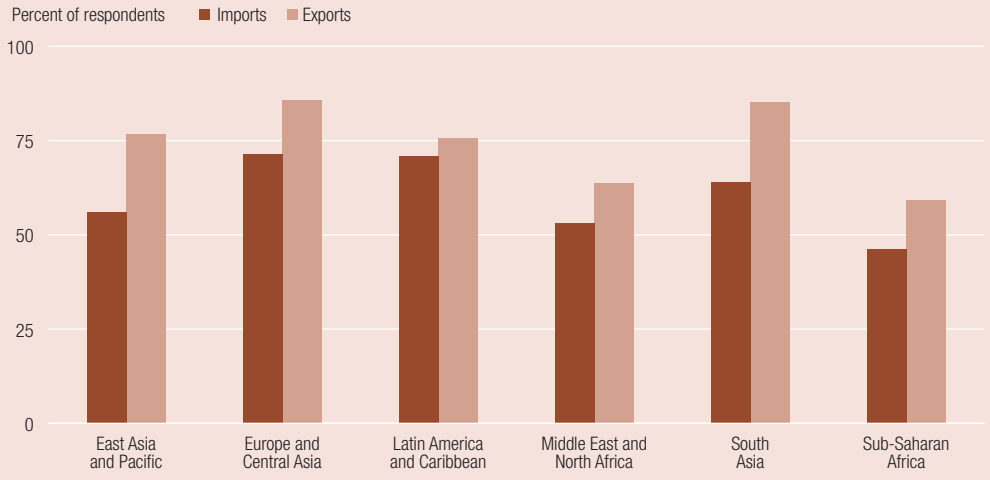
The figure illustrates this relationship. It uses the percentage of intermediate goods imports in total imports as a proxy for country-level integration in global value chains. The data source is the OECD–WTO Trade in Value Added Database. The upward-sloping line of best fit clearly indicates there is an association between better on-time performance and a higher proportion of imports accounted for by intermediates, which is representative of an important function of global value chains.

Correlation between timely clearance and delivery and share of intermediate imports



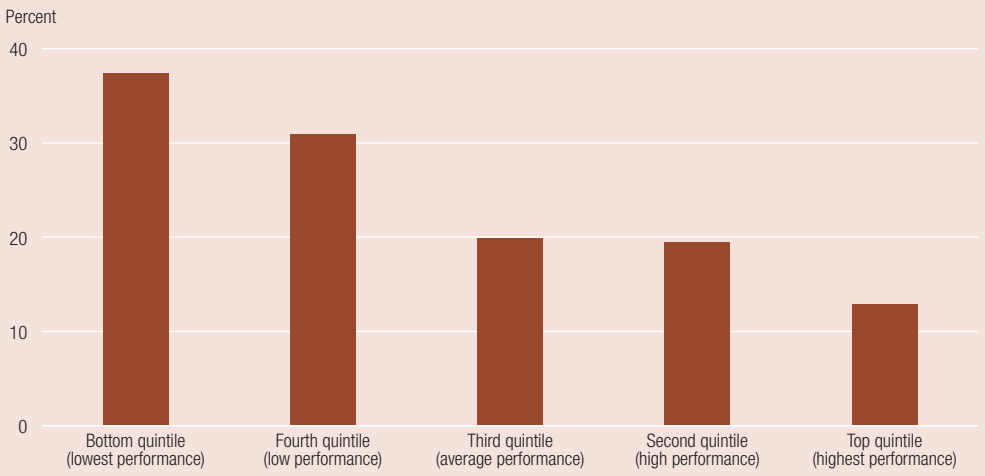
Source: Logistics Performance Index 2016.

Figure 2.7 Respondents reporting shipments often or nearly always cleared and delivered as scheduled, by region



Source: Logistics Performance Index 2016.

Figure 2.8 **Shipments not meeting company quality criteria, by LPI quintile**



Source: Logistics Performance Index 2016.

documentation. The acceptable quality window is much narrower (and errors much less tolerated) in top-performing countries than in low performing countries. The shipment quality gap only partly reflects these differing expectations.

SECTION 3

The way forward: New challenges in trade facilitation and logistics

It has been almost 10 years since the first edition of *Connecting to Compete*. The status of logistics as a policy concern is now firmly established. Not only private sector executives, but also policy makers across all types of countries are aware of the contribution of efficient supply chains to the national economy. The experience with policy implementation and interventions to enable logistics performance is diverse and increasingly well documented.

Yet the logistics agenda saw shifts in priorities over the last 10 years. First, the scope of policies addressing logistics performance is moving from border issues in trade and transport facilitation to domestic performance concerns. Moreover, the logistics industry and the public sector have to address major challenges such as raising skill and competency levels and adapting to slower trade growth. Managing the footprint and the sustainability of the supply chain is confirmed as a high priority, thereby reconciling performance with socioenvironmental objectives.

Complexity of reforms: Moving away from the border?

The focus of the LPI and its survey is the performance of international supply chains. Improvements in the crossborder movement of goods and logistics services, or trade and transport facilitation, has been the first area of attention of the LPI. Logistics policies are not limited to transportation or trade facilitation. They are part of a broader agenda that also includes services, the development of facilities, infrastructure, and spatial planning.

Trade and transport facilitation remains a priority for poorly performing countries

So far, in the context of developing countries, international forums and the support provided by international agencies have focused heavily on international trade and transport facilitation. Two areas have received substantial support over the last 15 years:

1. **Border management reforms** targeting improvements in customs processing and the coordination of controls by other agencies, for instance, risk management, the reduction of physical inspection, automation, and the implementation of single windows to facilitate information sharing, as well as the transparency of information and transactions for traders.
2. **Trade corridors and transport facilitation projects** are critical to addressing the needs of landlocked developing countries and targeting improvements such as transit and border infrastructure (for example, one-stop border facilities; box 3.1), transit procedures, and the reduction of controls in transit.

Arguably, there is an abundant return on experience in project design and implementation.[4] The principles of trade and transport facilitation have been formalized and adopted in a number of international agreements under the aegis of United Nations bodies and specialized agencies (World Customs Organization, WTO). Instruments such as the TIR Convention, the Kyoto Convention, and more recently the WTO Trade Facilitation Agreement have been playing an important role in motivating, guiding, and providing clear technical targets for projects in developing countries. Other initiatives, not necessarily global, are also energizing the agenda (box 3.2).

Some activities are known to be more difficult to implement, especially if improvements involve several countries. Countries with severe constraints, such as landlocked countries, have special needs. Transit regimes are difficult to improve despite the effective benchmarks

Box 3.1 Trade facilitation reforms: East Africa's Northern Corridor

The Northern Corridor links Burundi, Rwanda, and Uganda with Kenya's maritime port of Mombasa. It also serves the eastern part of the Democratic Republic of Congo, South Sudan, and Tanzania, connecting the five countries of the East African Community and beyond and playing an important role in the movement and trade of goods. The Northern Corridor was once known for multiple barriers to trade and transport, including lengthy dwell times at Mombasa port and cumbersome clearance procedures along the corridor. In 2012–13, the corridor countries started a series of reforms that significantly improved the logistics environment and drove down logistics costs.

One of the reforms was to introduce Single Customs Territory clearance procedures within the East African Community, including Burundi and Tanzania. This means final customs clearances for free circulation can be made already at the port of entry in Mombasa. Cargo is then released at this port by customs officials of a respective hinterland country such as Rwanda. Shipments do not have to be transported under customs control because official payments have already been made. The system has significantly reduced administrative burden and shortened the time required for customs formalities (see figure). Other important trade facilitation measures that have had a positive impact on the Northern Corridor include the following:

- Introducing a regional customs transit system
- Interconnecting customs information technology (IT) systems
- Introducing cargo tracking systems
- Improving interagency coordination
- Starting advance lodgment of declaration
- Detailed corridor monitoring on a weekly basis[a]
- Introducing networked single windows
- Introducing digital cargo tracking systems
- Building one-stop border posts
- Reducing weight controls and other controls

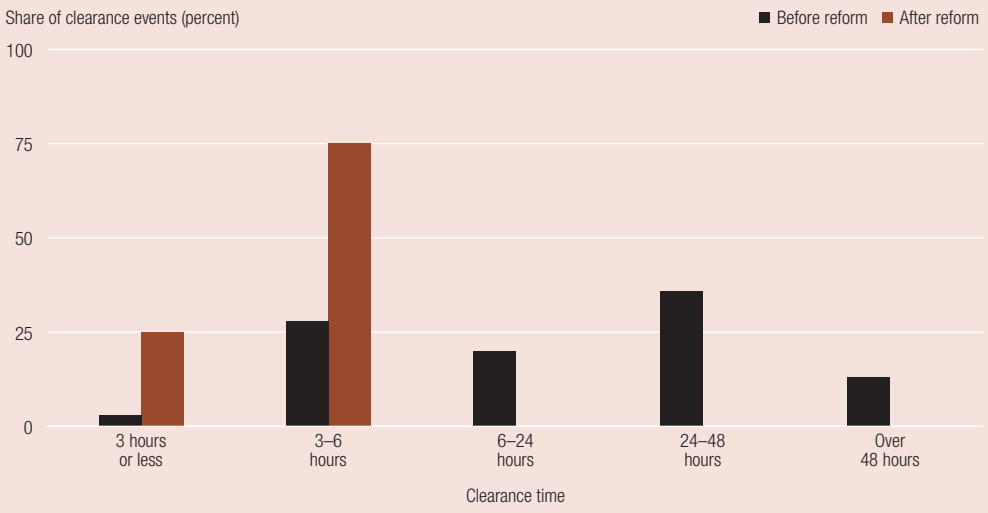
The positive impact of these reforms has been reported along the corridor, as follows:

- The average dwell time in Mombasa port was reduced from an average of 13 days in 2006 to 2–3 days in 2016.[b]
- The Malaba border crossing point between Kenya and Uganda registered a dramatic fall in border clearance times from 24 hours to 6 hours in December 2012 to January 2013.[c]
- Kenyan Customs Services estimate that the time taken to move cargo from Mombasa to Kampala dropped from 18 days to 3 days and from Mombasa to Kigali from 21 days to 6 days.

As result, the cost of doing business has decreased by about 50 percent.[d] The case of the Northern Corridor shows that the logistics environment can be quickly improved if there is strong political will for administrative reforms. In some cases, the reforms even preceded the infrastructure development. The example also shows that, considering the benefits for traders, the returns on investment in soft reforms can be much higher than any infrastructure project.

a. "Northern Corridor Performance Dashboard," Northern Corridor Transit and Transport Coordination Authority, Mombasa, Kenya, http://kandalakaskazini.or.ke.
b. World Bank data for 2005; "Northern Corridor Performance Dashboard," Northern Corridor Transit and Transport Coordination Authority, Mombasa, Kenya, http://kandalakaskazini.or.ke.
c. World Bank data.
d. Memo (2014).

Clearance times at the Kenya–Uganda border crossing point, Malaba



Source: World Bank.

Box 3.2 **Major new international initiatives address logistics issues**

Since the 2014 edition of the LPI, at least two initiatives of global scale have emerged that are likely to have positive impacts on the logistics performance of the participating countries.

One Belt, One Road: An initiative that will likely have significant implications for logistics operators is the One Belt, One Road Initiative, which is led by China and targets 60+ countries. This ambitious program seeks to improve trade connectivity among Silk Road economies and also countries on the main sea routes from China. While in its early stages, the initiative has an ambitious scope. It will target physical infrastructure in a variety of locations, catalyzing finance and investment resources. However, hard infrastructure is not enough. There also needs to be a soft component, involving regulatory reform in service markets such as transport, logistics, and telecommunications. China's trade costs with some initiative countries are high, particularly with Central Asian countries. From this starting point, the initiative can help develop a broad, business-focused program that can work on multiple fronts to bring improvements in trade facilitation and logistics to participating countries.

Trans-Pacific Partnership: The 12-country Trans-Pacific Partnership agreement was signed in February 2016, after seven years of negotiations.[a] Currently, its status is uncertain, as ratification is pending, including in the United States. It is not clear whether the process can be concluded in all countries.

From a logistics standpoint, there are a number of relevant aspects of the agreement. First, logistics is a service, so the agreement provisions on trade in services could facilitate international exchange involving logistics providers. The agreement also includes provisions on trade facilitation, in line with existing international agreements. One innovative aspect of the agreement that is important to the logistics community is the annex on express delivery services, which is designed to level the playing field among private sector delivery services and traditional postal operators. If implemented, there is potential for these provisions to facilitate the expansion of delivery services in countries where accessibility to such services is low.

a. Member countries include Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, the United States, and Vietnam.

provided by the transit system originating in Western Europe.[5] Service sector performance, notably of the trucking sector, is critical to the cost and reliability of inland logistics. Enhancing these markets is particularly challenging in Africa, especially because improvements have to be implemented in parallel in several countries.[6] The World Bank has recently piloted policy loans in Burkina Faso and Côte d'Ivoire with the objective of modernizing and consolidating the trucking sector in both countries.

The LPI survey results, especially the developments in section 2, confirm the prominence of the trade facilitation agenda. Yet they also show that, apart from the countries in the bottom performance quintiles, many developing countries have converged with the top performers. Use of information technology (IT) and the number of documents required for clearance, for instance, are not that different across the three top quintiles. Beyond a certain level, compliance with core guidelines in trade and transport facilitation may not be the main driver of logistics performance, and other factors such as behavior and productivity in logistics services and public agencies may be as important.

Comprehensive logistics strategies are being developed in middle- and high-income countries

However, logistics is not limited to transportation or trade facilitation. It is part of a broader agenda that includes services, the development of facilities, infrastructure, and spatial planning. Countries are increasingly confronted with a more complex set of reforms and measures to be implemented. Design and implementation ultimately happen at the country level or regionally, within consistent country groupings. High- and middle-income countries increasingly look at logistics not only from the perspective of reducing trade costs at the border, but of driving a large economic sector with many externalities because of its links with the rest of the economy and its significant social and environment footprint.

In physically large countries, internal commerce and logistics are an important topic because internal connectivity is critical to reducing geographical inequalities. Much of this has to do with logistics, including, in some cases, internal barriers. Given its focus and respondent base, the LPI is not entirely adequate to assess the performance of domestic logistics.

Many countries have engaged in comprehensive strategy exercises, with a strong public-private dialogue (box 3.3). The outcomes of these exercises vary: blueprints of priorities, monitoring and evaluation, or public–private promotion institutions such as Dinalog in the Netherlands. Some countries have promulgated laws on logistics with the intent of better defining the sector and its operating environment. The rationale for a law is that logistics integrates many activities and may not be properly supported by a regulatory framework designed for industrial or commercial enterprises. There is still limited international experience in this respect. The World Bank has so far advised two countries, Greece and Morocco, in preparing a regulatory framework for logistics.

A data-driven reform agenda

Policy makers are increasingly looking for data so they can base decisions on facts. General cross-country benchmarks such as the LPI are useful and are complemented by connectivity indicators for specific modes (shipping, air). They provide international comparability but remain coarse-grained benchmarks. More detailed and specific benchmarks are ultimately needed to take decisions and assess the impact of the decisions on ports, corridors, border crossings, trucking reforms, and so on. The needs are in two categories:

- Measures of performance outcomes of specific chains, for instance, on corridors or at ports, in terms of cost, time, and reliability. The automation of the supply chain process makes raw data available for these measurements. There is a now an extensive body of experience to measure corridor performance.[7]
- The impact of logistics costs and cost reduction on productivity and growth. Several governments or national logistics associations have monitored this impact through specific firm surveys, for example, Brazil, France, Germany, Malaysia, the Nordic countries, and Thailand. These surveys try to estimate logistics expenditures in manufacturing and commerce and to break down the operating costs of service providers. The Finnish survey model has been replicated in several countries, including Greece and Kazakhstan.[8]

Logistics observatories are being developed to collect, organize, and interpret these datasets.[9] A few countries, including Canada, the Netherlands, and South Africa are devising even more ambitious big data investments that try to map a country's entire set of supply chains, from shipper information to tracking data and beyond (box 3.4).

Raising competencies under competitive pressure

Most experts agree that the 2008 financial crisis coincided with new trends in global trade, ending a phase when trade, and hence logistics, grew faster than production. According to the WTO, both trade and production growth have averaged at 2.5 percent since the crisis.[10] As a result, many transport and logistics market segments have been struggling with overcapacity, low freight levels, and poor profitability. The impact on the main segments and the response from the industry are briefly explained below. This puts pressure on the industry to evolve in terms of networks and products. Proactive policies to enhance the quality and competitiveness of logistics services should also adapt to this new normal for trade and logistics.

Box 3.3 France Logistique 2025

"In France, following a Parliament initiative, a national conference on logistics was organized in 2015, prepared by a scientific committee establishing a state of the art and a diagnosis of the current situation. For the first time, the government approved a strategic plan for logistics (France Logistique 2025), which has now to be implemented. It should be organized around six main topics: manpower, competence, and education; insertion of logistics in its regional and urban environment; research and innovation in logistics technology and management; infrastructure usage optimization; regulation harmonization and simplification; and observation of logistics (measurement of its social, economic, and environmental performance) under the governance of a steering committee."

Source: Savy 2016.

Box 3.4 **South Africa: Letting the (large) logistics data speak**

South Africa embodies the familiar story of a developing economy with a heavy dependence on bulk industries, a rapidly growing service sector, and a struggling manufacturing sector. Although logistics costs as a percentage of GDP have decreased 2.4 percentage points since 2008, they are equivalent to approximately 50 percent of GDP in U.S. dollars in the primary and secondary sectors. These and other provocative statistics have found their way onto the desks of policy makers and infrastructure planners purely as a result of almost two decades of dedicated datacentric research of freight flows and logistics costs by a consortium of experts involving the private sector and the research community, the Council for Scientific and Industrial Research, and Stellenbosch University.

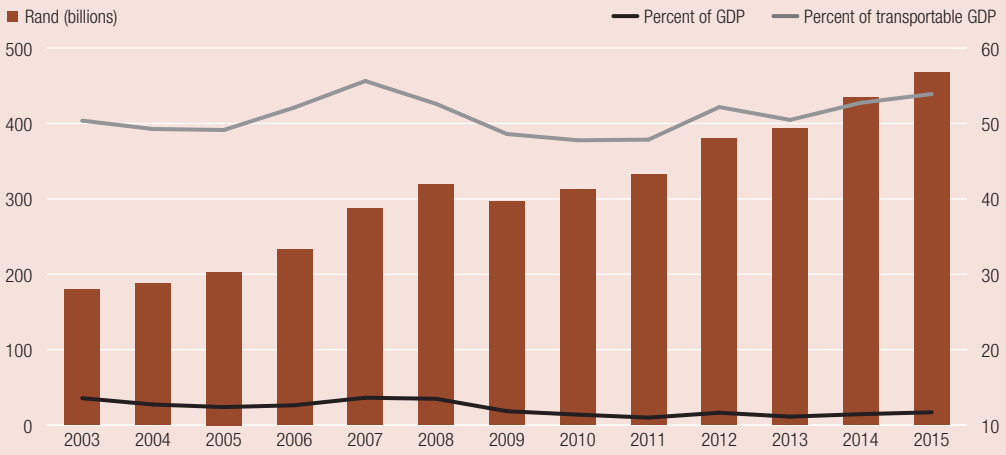
Together with the United States, South Africa is one of the few countries that have a consistent, statistics-based time series of macrologistics costs (see figure). Between 2004 and 2014, this work was presented annually in the State of Logistics™.[a] From 2015, the State of Logistics™ survey was succeeded by Logistics Barometer South Africa, published by Stellenbosch University.[b] The Logistics Barometer delves deeper into the cost drivers and market dynamics that shape logistics behavior and provides a detailed picture, geographically and by industry, of how the South African economy moves. It is a significant step up in collecting, calibrating, and analyzing large sets of data from many, mostly private sources.

a. State of Logistics™ Surveys (database), Council for Scientific and Industrial Research, Pretoria, South Africa, http://www.csir.co.za/sol/.

b. Logistics Barometer (database), Stellenbosch University, Stellenbosch, South Africa, http://www.sun.ac.za/english/faculty/economy/logistics/Pages/logisticsbarometer.aspx.

Source: Jan Havenga, Department of Logistics, Stellenbosch University.

Logistics costs, South Africa, 2003–15



Source: Logistics Performance Index 2016.

More networks: The logistics industry response to the decline in impacts on trade growth

Starting with maritime transport, the shipping market has seen record low freight levels since 2008, and the near-term outlook is bleak, especially in bulk and tanker shipping. The main freight index for bulk shipping reached an all-time low in February 2016, and the corresponding tanker indexes have either been very low or low during most of 2016.[11] This development reflects the substantial oversupply in these trades even though the world seaborne trade has grown since the 2008–09 crisis from around 7,860 million tons or 40,000 billion ton-miles in 2009 to over 10,000 million tons and over 54,000 billion ton-miles in 2015.[12]

Despite the high average growth of global container volumes (approximately 5 percent a year since 2010), container freight levels have remained low, even if some recovery is expected later in 2016.[13] Over 20 ships carrying more than 18,000 twenty-foot equivalent units (TEU) have entered the main trades since 2013, and over half of all containership orders placed in 2015 were in the 18,000–22,000 TEU range.

This has had a substantial impact on operational patterns and competition in container shipping. While low maritime freights should be good news for shippers, even record low levels do not necessarily generate more transport volumes.[14]

According to Boeing, air cargo currently constitutes only about 1 percent of world trade calculated by tonnage, but it represents about 35 percent of world trade calculated by the value of goods shipped.[15] The importance of air freight to trade logistics is thus substantial. The global air freight market was severely affected by the economic crisis of 2008 as well: the post-crisis peak of 2011 of about 195 billion freight ton kilometers was not surpassed until 2015. Airbus predicts a 4.4 percent annual growth from about 200 billion freight ton kilometers in 2015 to about 480 billion by 2034. This will be largely driven by emerging markets, especially in the Asia and Pacific region, where both general and express cargoes are expected to continue to expand.

According to the listing of the world's largest freight forwarders by Armstrong & Associates for 2013 and 2014, the revenues of the same top 20 firms were US$185 billion and US$189 billion, respectively.[16] The freight forwarding industry, including the largest logistics service providers, has witnessed a dilution of yields especially since 2008, and profitability has generally been low.[17] The global freight forwarding market is still fragmented into a mix of global providers, hundreds of medium enterprises, and tens of thousands of small competitors subjected to disruptive market forces ranging from shifting demand patterns and increasingly complex global supply chains to an evolving customer base and changing customer relationships.

This means that forwarders have to work harder to maintain their revenues and, more importantly, their profitability. One of the reasons for this is a shift in modes from air to sea.[18] A key driver behind this trend was the economic downturn, which prompted traders to find ways to cut their supply chain costs while maintaining their efficiency. Global flows of goods have also become more disparate: In the early 1990s, two-thirds of global flows of goods moved through the top 50 routes compared with approximately one-third by 2010.[19]

Many of the big logistics service providers have struggled with operational issues, including legacy IT systems, which may be based on an IT architecture from the 1990s. Switching corporate-wide to the latest IT systems in a highly competitive market poses significant risks of disruption and loss of market share, which has been a major reason to postpone such changes. A significant feature in recent years, especially among the large providers, is the growing emphasis on more sustainable and environmentally friendly practices. This is largely a customer-driven response, and market indications imply that providers with sustainable operations will thrive in tomorrow's marketplace.

Small and medium freight forwarders are being forced to evolve to become better and more efficient in an environment where manual data entry is still widespread. They have evolved from pure forwarders to providers of a wider range of services, such as integrated or third- or fourth-party logistics services. This often involves the creation and maintenance of or allegiance to wide networks, typically as a non–asset-based operator. This means that freight forwarders, as middlemen among consignors, consignees, and the necessary logistics providers, seldom own the facilities or means of transport themselves.

A notable recent feature in the way small and medium freight forwarders develop their business and try to increase their sales is the emergence of large and geographically extensive, even worldwide, alliances. Adherence to such alliances—some with several hundred corporate members—does not typically entail large investments, even if some IT system alignment may be required, especially in marketing, customer management, and selected operational interfaces. Some of the more established alliances are exclusive so that one cannot have multiple memberships in competing networks or alliances. Some have various tiers of membership. There are currently tens if not hundreds of such freight forwarder networks. The formation of this type of network during the past decade or so is not new. Indeed, this has

been the modus operandi in freight forwarding for centuries. What is novel is the way these alliances are formed and maintained and how their members can provide more versatile services to cater to a broad spectrum of customer needs with wide geographical coverage.

The big firms in the business have tried to reach similar competitive advantage through the extensive internalization of such operations, combined with networking in markets, where independent operations are not feasible. As a result, freight forwarding is currently a highly competitive business in most parts of the world. This also creates a need for operators in the freight forwarding business to develop more value added services and to provide such services to shippers in developing markets, too.[20]

Logistics skills, competencies, and training

Transporting, storing, and handling goods are labor-intensive activities. The availability of skilled logistics staff is thus an important determinant of supply chain performance. A forthcoming joint report by the World Bank Global Trade Team and Kühne Logistics University in Hamburg reviews the availability of qualified staff and the current state of training and education in logistics in 28 developing and developed countries.[21] To supplement the report's analysis, the 2016 LPI edition for the first time included a question on logistics skills and competencies. Respondents were asked to indicate the availability (from very high to very low) of qualified personnel in four groups of logistics personnel:

- Operations staff such as truck drivers or warehouse pickers
- Administrative staff such as traffic planners, expediters, or warehouse clerks
- Logistics supervisors such as warehouse shift leaders or traffic controllers
- Logistics managers such as those responsible for transport, warehousing operations, or supply chain management

The results of the 2016 LPI survey bolster the report's findings that logistics faces a global shortage of qualified staff. Qualified staff are scarce at all four occupational levels in both developed and developing countries, but particularly in the countries that form the bottom quintile in the LPI (figure 3.1). In these countries, the shortage of logistics staff in the middle tier, that is, administrative staff and supervisors, is most acute. A similar picture emerges in the second-lowest LPI quintile, where the share of low or very low availability was rated at around a third for all four occupational levels. The problem of skill shortages is less acute, but also visible in the third, fourth, and fifth LPI quintile.

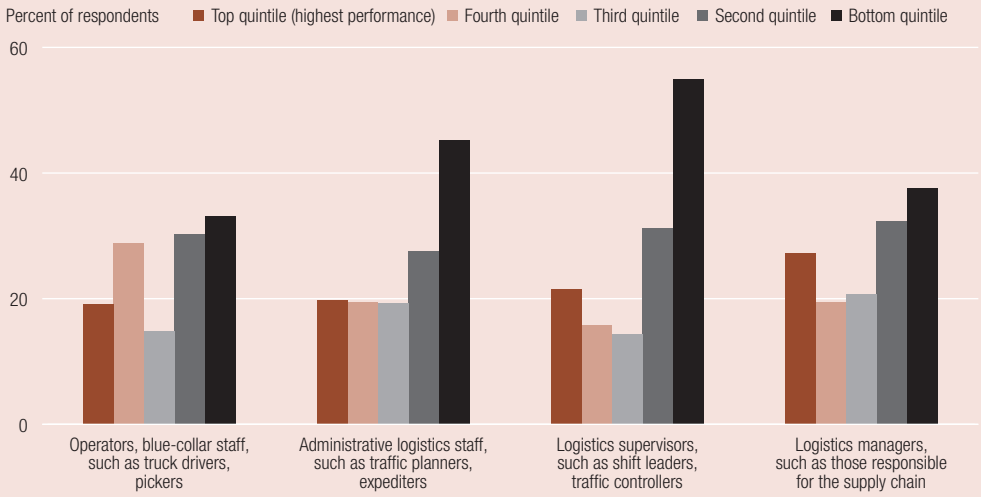
When broken down by geographic region, Latin America and the Caribbean emerges as the region with the highest skill gap across all employee groups (figure 3.2). A full 43 percent of respondents, for instance, indicated that the availability of logistics managers, that is, those with the most sophisticated responsibilities, was either low or very low. Yet, also for each of the three remaining employee groups (operative, administrative, and supervisory), about a third of respondents indicated low or very low availability of staff.

Comparatively high staff shortages of between 20 percent and 30 percent at all job levels were reported in South Asia and Sub-Saharan Africa. The picture is more nuanced in East Asia and Pacific, were shortages of administrative and managerial staff were more acute than those of operative and supervisory staff. In the Middle East and North Africa, the low level of staff shortage at the managerial level (11 percent) vs. the other levels (around 20 percent each) stands out. This could be a favorable outcome of higher education programs (Bachelor of Science and Master of Science) in logistics and supply chain management that were introduced in the region over the past decade. Morocco could serve as an example of a country that, owing to those programs, does not see a severe shortage of managerial staff. However, difficulties in finding workers on lower sophistication levels, such as truck drivers and warehouse pickers, are still pertinent in the country.

Other findings emerging from the report of the World Bank and Kühne Logistics University include the following:

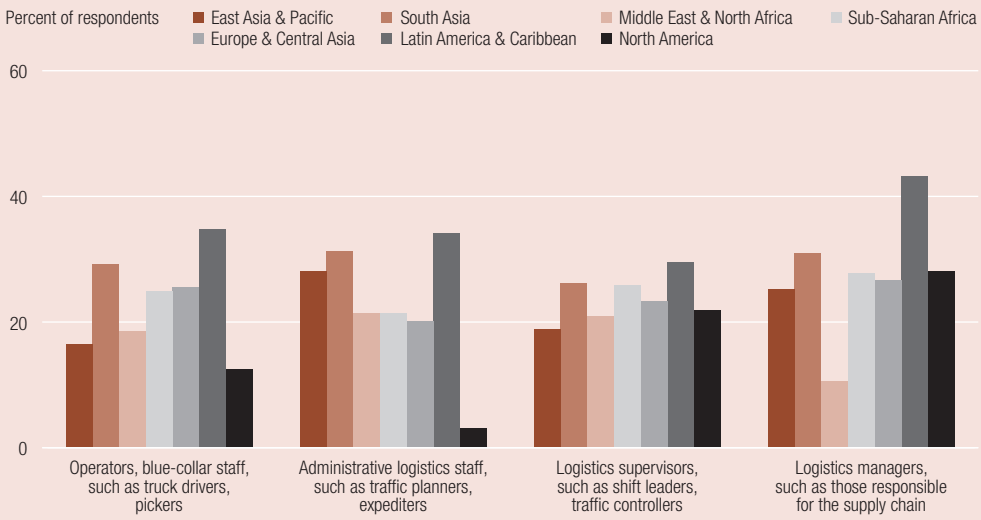
- Hiring and retaining issues range from difficulties in finding or retaining truck drivers

Figure 3.1 **Respondents reporting low or very low availability of qualified personnel, by employee group and LPI quintile**



Source: Logistics Performance Index 2016.

Figure 3.2 **Respondents reporting low or very low availability of qualified personnel, by employee group and region**



Source: Logistics Performance Index 2016.

to problems in filling senior supply chain management positions; the latter is most acute in emerging markets. This is compounded by deficiencies in the skill levels of the staff currently employed in the logistics sector. Hence, productivity of logistics operations and the quality of logistics services are suffering.

- With the exception of a few countries, such as Germany or the United Kingdom, logistics training is often limited to short-term, on-the-job training, characterized by small training budgets, few sources of expertise, and low quality in the educational experience.
- The reasons for the skill shortage include low salary levels relative to other sectors, the

low prestige of operational logistics workers, lack of vocational school preparation, limited labor supply in remote areas where logistics hubs are often located, and new IT developments in logistics that exceed the competencies of the existing workforce.

To address skill shortages in the logistics sector, training is needed that can be implemented even on tight budgets and low maturity levels in the educational and logistics sector. Apprenticeships and dual education initiatives such as in Germany could form part of this, as could branch campuses of established universities or blended learning approaches. Companies can do their share to retain employees by offering transparent career paths, investment in workforce development, appealing work environments, and a fair distribution of rewards and responsibilities. Governments can support higher competency levels in the logistics sector through several interventions, including regulatory policy, curriculum development, financial support for training initiatives, harmonization of competence standards, and supplementing infrastructure development with human capital investment.

Managing the footprint and sustainability of logistics

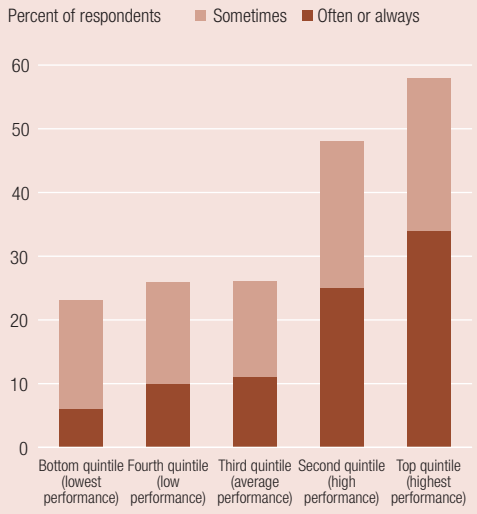
Green logistics

This edition of the survey, like the two previous editions, included a question on the demand for environmentally friendly international logistics. The results show the same pattern as in the past two editions. Environmentally friendly supply chains are associated with a higher degree of logistics performance (figure 3.3). This trend is good news because logistics has a relatively large footprint not only on the economy but also on the environment. Beyond its freight component, the magnitude of the carbon footprint of logistics is not well estimated. The share of freight emissions of greenhouse gases has been estimated at 42 percent of transport emissions and 7 percent of total emissions.[22] In the long term, the share of freight logistics is expected to grow to 60 percent of transport emissions in 2050.[23]

These results are consistent with the growing voluntary targets set by a number of large multinational corporations. Many of these have publicized ambitious reductions in carbon intensity relative to outputs, between 20 percent and 40 percent in 2010–20.[24] Typically, these objectives are expected to be achieved by shifting to less emission-heavy modes of transportation and also by better load factors in freight transportation. This demand for environmentally friendly logistics complements the toolkit of policy interventions targeting green transportation that typically promotes energy efficiency or alters the energy mix through incentives and better standards.[25]

From a policy standpoint, what is less clear today is how to develop policy interventions that not only target the supply side of logistics but also raise the demand for environmentally friendly logistics, including in developing countries. Few countries—prominently, the Netherlands through the Lean and Green Program—have implemented policies and public–private dialogue targeting not only the transport sector but also the shippers.[26]

Figure 3.3 **The demand for green logistics**



Note: The figure shows the share of the respondents answering often, always, or sometimes to the question "How often do shippers ask for environmentally friendly options (for example, in view of emission levels, choice of routes, vehicles, schedules, and so on) in shipping to country x?" The economies are grouped by LPI quintiles.
Source: Logistics Performance Index 2016.

Logistics and spatial planning

Another major sustainability concern, more local in nature, revolves around the physical footprint of logistics. Because of growing urbanization in developing countries, rapidly increasing urban freight transport has a significant impact economically (such as through inefficiencies and urban competitiveness), environmentally (air pollution and noise), and socially (quality of life, health, and economic possibilities).

Most logistics activities require large land areas for various types of facilities, such as warehouses, and good transport infrastructure connections to and from these locations. Yet most of the goods are ultimately distributed and sold in dense areas. Logistics, including activities such as warehousing, not only compete for space but also generate traffic in high-density areas. Several authors have noted the dominance of the traditional sector in many developing countries and the fact that this sector is likely to remain dominant.[27] Retail stores in developing countries often operate with small volumes and limited inventory. This implies high densities in logistics because of the need for many small deliveries with more intermediary steps.

In port cities, the development of the busiest seaports and airports has often been constrained by a lack of suitable land for expansion, especially facilities in locations close to or even within urban or suburban areas. In many large ports in Europe and Asia, the surge in traffic to and from China around 2004/05 prompted ports to develop inland locations—dry ports—to handle the rapidly growing volumes in a more efficient and environmentally friendly manner.[28]

The implementation of relevant city logistics measures, policies, planning, and regulations can reduce these effects and contribute to economic, environmental, and social sustainability. Hence, to provide sustainable development, city logistics are crucially important.[29] Although not covered yet in the LPI survey, logistics in cities is attracting rapidly growing attention among policy makers who have to reconcile the objective of efficient logistics with spatial concerns. The World Bank is thus increasingly involved in urban logistics projects in Brazil, China, Kenya, Morocco, and other countries.

* * *

Logistics not only connects firms to domestic and international markets, but also links to broader policy concerns. Previous LPI reports emphasized the complexity of the reform agenda and the differentiation in priorities depending on the level of logistics performance. These remain relevant.

In countries with low performance, logistics reforms are still intertwined with the trade and transport facilitation agenda dealing with border management improvements, transit facilitation, and enhancements of core infrastructure, notably corridors and border facilities. Countries at intermediate and high levels of performance deal with broader and more complex issues, which not only target the border component of supply chains but also the full array of policies addressing the performance and externalities of domestic supply chains.

Therefore, the policy frontiers outlined above are likely to receive growing attention from policy makers, especially in advanced and emerging economies as well as among the organizations advising them. Areas such as domestic supply chains, sustainability, or labor supply and skills are accompanied by innovative potential and require significant investments in the practical knowledge of what does and does not work. Thus, the World Bank has developed a strong interest in implementing new approaches to improving urban and distribution logistics or the use of big data to map domestic supply chains.

Notes

1 "La France fait partie des pays du monde les plus performants pour sa logistique. C'est un facteur déterminant de notre compétitivité, qui représente 10 % du PIB national, 200 milliards d'euros de chiffres d'affaires, et 1,8 millions d'emplois. Notre pays est notamment reconnu pour la qualité de sa main d'oeuvre, de son maillage d'infrastructures et d'équipements, ou encore la disponibilité de ses terrains. Mais cette position n'est jamais acquise et la France doit encore progresser pour devenir un leader mondial. Classée seulement au 13ème rang mondial de la logistique (indice Banque mondiale), loin derrière ses voisins les plus proches, la sousperformance logistique de la France coûterait chaque année entre 20 et 60 milliards d'euros à notre économie" (Royal, Macron, and Vidalies 2016, 2).

2 Although the respondents in the LPI survey are freight forwarders and express carriers, the quality and competence of service providers are assessed by their peers.

3 Lead time to import is the median time (the value for 50 percent of shipments) from the port of discharge to arrival at the consignee.

4 McLinden et al. (2011).

5 Kunaka and Carruthers (2014).

6 Raballand and Teravaninthorn (2009).

7 Raballand et al. (2008).

8 Solakivi et al. (2012).

9 ITF (2016).

10 WTO (2015).

11 See "Baltic Dry Index," Lloyd's List (database), Quandl, Toronto, https://www.quandl.com/data/LLOYDS/BDI. See also "Baltic Tanker Index," Lloyd's List Intelligence (database), Maritime Intelligence, Informa UK Limited, London, http://www.lloydslistintelligence.com/llint/tankers/baltic-index.htm.

12 UNCTAD (2015).

13 UNCTAD (2015). Also see, for example, Lakshmi (2016); Hong Liang (2016).

14 UNCTAD (2015).

15 Boeing (2015).

16 See Logistics Management (2014, 2015). The five largest in 2014 by revenue from logistics operations according to Armstrong & Associates were: 1. DHL Supply Chain & Global Forwarding (US$32.2 billion); 2. Kühne + Nagel (US$23.3 billion); 3. DB Schenker Logistics (US$19.9 billion); 4. Nippon Express (US$17.9 billion); and 5. Panalpina (US$7.3 billion). The total revenue of these five was US$100.6 billion, or 53.2 percent of the top 20 firms. Four of the top 5 and 10 of the top 20 firms were headquartered in Europe.

17 See also Stifel Logistics Confidence Index indications in March 2016 at https://www.ajot.com/news/a-return-to-decline-stifel-logistics-confidence-index-falls-month-on-month.

18 Manners-Bell and Lyon (2015).

19 http://www.scmr.com/article/freight_forwarding_market_going_through_structural_change.

20 See also Langley and Capgemini Consulting (2014).

21 World Bank and KLU, forthcoming.

22 ITF (2015).

23 ITF (2015).

24 Kopp, Block, and Iimi. (2012); McKinnon et al. (2010).

25 Kopp, Block, and Iimi. (2012); McKinnon et al. (2010).

26 www.lean-green.nl.

27 Blanco (2014).

28 Cullinane, Bergqvist, and Wilmsmeier (2012).

29 Savy (2014).

APPENDIX 1

International LPI results

	LPI rank			LPI score				Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Lower bound	Upper bound	Score	Lower bound	Upper bound	% of highest performer	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Germany	1	1	4	4.23	4.18	4.27	100.0	2	4.12	1	4.44	8	3.86	1	4.28	3	4.27	2	4.45
Luxembourg	2	1	12	4.22	3.97	4.47	99.8	9	3.90	4	4.24	1	4.24	10	4.01	8	4.12	1	4.80
Sweden	3	1	7	4.20	4.09	4.32	99.3	8	3.92	3	4.27	4	4.00	2	4.25	1	4.38	3	4.45
Netherlands	4	1	6	4.19	4.11	4.27	98.8	3	4.12	2	4.29	6	3.94	3	4.22	6	4.17	5	4.41
Singapore	5	2	9	4.14	4.06	4.22	97.4	1	4.18	6	4.20	5	3.96	5	4.09	10	4.05	6	4.40
Belgium	6	5	9	4.11	4.04	4.18	96.4	13	3.83	14	4.05	3	4.05	6	4.07	4	4.22	4	4.43
Austria	7	3	11	4.10	3.98	4.21	96.0	15	3.79	12	4.08	9	3.85	4	4.18	2	4.36	7	4.37
United Kingdom	8	6	9	4.07	4.03	4.11	95.2	5	3.98	5	4.21	11	3.77	7	4.05	7	4.13	8	4.33
Hong Kong SAR, China	9	6	9	4.07	4.00	4.14	95.1	7	3.94	10	4.10	2	4.05	11	4.00	14	4.03	9	4.29
United States	10	10	12	3.99	3.94	4.04	92.8	16	3.75	8	4.15	19	3.65	8	4.01	5	4.20	11	4.25
Switzerland	11	10	15	3.99	3.92	4.06	92.6	10	3.88	7	4.19	14	3.69	14	3.95	12	4.04	14	4.24
Japan	12	10	15	3.97	3.92	4.02	92.1	11	3.85	11	4.10	13	3.69	12	3.99	13	4.03	15	4.21
United Arab Emirates	13	10	16	3.94	3.88	4.00	91.2	12	3.84	13	4.07	7	3.89	18	3.82	18	3.91	18	4.13
Canada	14	10	16	3.93	3.83	4.03	90.8	6	3.95	9	4.14	29	3.56	15	3.90	9	4.10	25	4.01
Finland	15	9	20	3.92	3.77	4.07	90.5	4	4.01	16	4.01	30	3.51	16	3.88	11	4.04	16	4.14
France	16	13	16	3.90	3.84	3.96	89.9	17	3.71	15	4.01	20	3.64	19	3.82	15	4.02	13	4.25
Denmark	17	6	30	3.82	3.51	4.12	87.3	14	3.82	24	3.75	15	3.66	9	4.01	25	3.74	30	3.92
Ireland	18	11	30	3.79	3.60	3.99	86.6	25	3.47	22	3.77	10	3.83	20	3.79	16	3.98	29	3.94
Australia	19	10	30	3.79	3.58	4.00	86.6	22	3.54	18	3.82	21	3.63	17	3.87	19	3.87	21	4.04
South Africa	20	17	24	3.78	3.70	3.85	86.0	18	3.60	21	3.78	23	3.62	22	3.75	17	3.92	24	4.02
Italy	21	18	24	3.76	3.70	3.81	85.4	27	3.45	19	3.79	17	3.65	21	3.77	20	3.86	22	4.03
Norway	22	15	30	3.73	3.54	3.92	84.7	20	3.57	17	3.95	25	3.62	24	3.70	22	3.82	39	3.77
Spain	23	17	29	3.73	3.62	3.84	84.5	24	3.48	25	3.72	22	3.63	23	3.73	23	3.82	26	4.00
Korea, Rep.	24	20	28	3.72	3.64	3.79	84.2	26	3.45	20	3.79	27	3.58	25	3.69	24	3.78	23	4.03
Taiwan, China	25	15	30	3.70	3.47	3.92	83.6	34	3.23	26	3.57	28	3.57	13	3.95	31	3.59	12	4.25
Czech Republic	26	17	30	3.67	3.52	3.83	82.9	19	3.58	35	3.36	18	3.65	26	3.65	21	3.84	28	3.94
China	27	25	29	3.66	3.61	3.71	82.5	31	3.32	23	3.75	12	3.70	27	3.62	28	3.68	31	3.90
Israel	28	17	30	3.66	3.47	3.85	82.5	23	3.50	30	3.49	37	3.38	28	3.60	26	3.72	10	4.27
Lithuania	29	18	30	3.63	3.45	3.82	81.6	28	3.42	27	3.57	31	3.49	30	3.49	27	3.68	17	4.14
Qatar	30	17	38	3.60	3.36	3.84	80.6	21	3.55	28	3.57	26	3.58	29	3.54	35	3.50	35	3.83
Hungary	31	31	44	3.43	3.30	3.56	75.3	49	3.02	32	3.48	34	3.44	34	3.35	41	3.40	33	3.88
Malaysia	32	31	41	3.43	3.34	3.52	75.2	40	3.17	33	3.45	32	3.48	35	3.34	36	3.46	47	3.65
Poland	33	31	44	3.43	3.30	3.56	75.2	33	3.27	45	3.17	33	3.44	31	3.39	37	3.46	37	3.80
Turkey	34	31	44	3.42	3.28	3.56	75.1	36	3.18	31	3.49	35	3.41	36	3.31	43	3.39	40	3.75
India	35	31	38	3.42	3.36	3.48	75.0	38	3.17	36	3.34	39	3.36	32	3.39	33	3.52	42	3.74
Portugal	36	31	44	3.41	3.27	3.55	74.7	30	3.37	49	3.09	47	3.24	47	3.15	29	3.65	27	3.95
New Zealand	37	25	56	3.39	3.07	3.71	74.0	37	3.18	29	3.55	80	2.77	41	3.22	32	3.58	19	4.12
Estonia	38	31	53	3.36	3.13	3.60	73.3	29	3.41	44	3.18	56	3.07	46	3.18	48	3.25	20	4.08
Iceland	39	30	55	3.35	3.07	3.62	72.7	43	3.13	51	3.02	42	3.32	39	3.26	40	3.42	32	3.88
Panama	40	30	56	3.34	3.07	3.61	72.5	42	3.13	38	3.28	16	3.65	45	3.18	63	2.95	41	3.74
Slovak Republic	41	31	53	3.34	3.12	3.56	72.4	32	3.28	39	3.24	36	3.41	51	3.12	55	3.12	36	3.81
Kenya	42	31	48	3.33	3.21	3.45	72.3	39	3.17	42	3.21	46	3.24	40	3.24	38	3.42	46	3.70

	LPI rank			LPI score			% of highest performer	Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Lower bound	Upper bound	Score	Lower bound	Upper bound		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Latvia	43	31	53	3.33	3.12	3.53	72.1	45	3.11	41	3.24	44	3.28	37	3.29	39	3.42	49	3.62
Bahrain	44	31	53	3.31	3.11	3.51	71.7	41	3.14	48	3.10	41	3.33	33	3.38	44	3.32	51	3.58
Thailand	45	43	50	3.26	3.18	3.33	69.9	46	3.11	46	3.12	38	3.37	49	3.14	50	3.20	52	3.56
Chile	46	31	58	3.25	3.00	3.50	69.7	35	3.19	63	2.77	43	3.30	56	2.97	34	3.50	44	3.71
Greece	47	38	54	3.24	3.10	3.38	69.4	55	2.85	37	3.32	64	2.97	60	2.91	30	3.59	34	3.85
Oman	48	31	58	3.23	3.00	3.47	69.3	61	2.76	34	3.44	40	3.35	38	3.26	57	3.09	57	3.50
Egypt, Arab Rep.	49	44	56	3.18	3.05	3.32	67.7	65	2.75	50	3.07	45	3.27	43	3.20	54	3.15	48	3.63
Slovenia	50	35	67	3.18	2.95	3.42	67.7	53	2.88	43	3.19	53	3.10	44	3.20	46	3.27	60	3.47
Croatia	51	37	67	3.16	2.93	3.39	67.0	47	3.07	53	2.99	51	3.12	42	3.21	52	3.16	67	3.39
Saudi Arabia	52	45	58	3.16	3.03	3.28	66.8	68	2.69	40	3.24	48	3.23	54	3.00	49	3.25	53	3.53
Kuwait	53	40	66	3.15	2.96	3.35	66.7	56	2.83	56	2.92	24	3.62	70	2.79	53	3.16	55	3.51
Mexico	54	45	66	3.11	2.96	3.27	65.5	54	2.88	57	2.89	61	3.00	48	3.14	42	3.40	68	3.38
Brazil	55	49	62	3.09	2.99	3.19	64.7	62	2.76	47	3.11	72	2.90	50	3.12	45	3.28	66	3.39
Malta	56	45	71	3.07	2.84	3.30	64.1	59	2.78	55	2.94	55	3.09	65	2.85	56	3.12	50	3.61
Botswana	57	45	71	3.05	2.82	3.27	63.4	48	3.05	54	2.96	70	2.91	75	2.74	70	2.89	43	3.72
Uganda	58	53	67	3.04	2.93	3.15	63.3	51	2.97	67	2.74	74	2.88	57	2.93	59	3.01	45	3.70
Cyprus	59	49	73	3.00	2.78	3.22	62.0	44	3.11	52	3.00	78	2.80	76	2.72	98	2.54	38	3.79
Romania	60	51	72	2.99	2.81	3.18	61.8	50	3.00	58	2.88	57	3.06	67	2.82	64	2.95	81	3.22
Tanzania	61	56	68	2.99	2.89	3.09	61.7	60	2.78	60	2.81	63	2.98	58	2.92	60	2.98	64	3.44
Rwanda	62	51	72	2.99	2.80	3.17	61.6	52	2.93	76	2.62	59	3.05	63	2.87	58	3.04	69	3.35
Indonesia	63	51	72	2.98	2.80	3.17	61.5	69	2.69	73	2.65	71	2.90	55	3.00	51	3.19	62	3.46
Vietnam	64	49	76	2.98	2.76	3.20	61.3	64	2.75	70	2.70	50	3.12	62	2.88	75	2.84	56	3.50
Uruguay	65	51	73	2.97	2.79	3.16	61.2	58	2.78	61	2.79	69	2.91	53	3.01	74	2.84	59	3.47
Argentina	66	55	71	2.96	2.81	3.11	60.8	76	2.63	59	2.86	81	2.76	66	2.83	47	3.26	61	3.47
Jordan	67	51	79	2.96	2.74	3.17	60.7	83	2.55	62	2.77	49	3.17	61	2.89	62	2.96	71	3.34
Pakistan	68	59	71	2.92	2.81	3.04	59.6	71	2.66	69	2.70	66	2.93	68	2.82	67	2.91	58	3.48
Peru	69	57	81	2.89	2.72	3.06	58.7	63	2.76	75	2.62	68	2.91	64	2.87	65	2.94	80	3.23
Brunei Darussalam	70	51	98	2.87	2.57	3.17	58.0	57	2.78	66	2.75	62	3.00	93	2.57	68	2.91	84	3.19
Philippines	71	60	82	2.86	2.72	3.00	57.5	78	2.61	82	2.55	60	3.01	77	2.70	73	2.86	70	3.35
Bulgaria	72	57	100	2.81	2.56	3.05	56.0	97	2.40	101	2.35	67	2.93	52	3.06	80	2.72	72	3.31
Cambodia	73	59	99	2.80	2.57	3.04	55.8	77	2.62	99	2.36	52	3.11	89	2.60	81	2.70	73	3.30
Ecuador	74	60	99	2.78	2.56	2.99	55.1	74	2.64	88	2.47	65	2.95	84	2.66	86	2.65	77	3.23
Algeria	75	59	107	2.77	2.51	3.03	54.9	108	2.37	80	2.58	77	2.80	59	2.91	72	2.86	91	3.08
Serbia	76	66	101	2.76	2.56	2.97	54.6	87	2.50	85	2.49	90	2.63	69	2.79	66	2.92	79	3.23
Kazakhstan	77	68	101	2.75	2.55	2.95	54.3	86	2.52	65	2.76	82	2.75	92	2.57	71	2.86	92	3.06
Bahamas, The	78	69	98	2.75	2.58	2.92	54.2	72	2.65	68	2.72	79	2.80	73	2.74	87	2.64	105	2.93
Namibia	79	66	103	2.74	2.52	2.97	54.1	73	2.65	64	2.76	86	2.69	86	2.63	100	2.52	85	3.19
Ukraine	80	70	95	2.74	2.60	2.87	53.8	116	2.30	84	2.49	95	2.59	95	2.55	61	2.96	54	3.51
Burkina Faso	81	70	99	2.73	2.57	2.89	53.7	84	2.55	71	2.67	83	2.73	71	2.78	103	2.49	88	3.13
Lebanon	82	54	136	2.72	2.31	3.12	53.2	66	2.73	74	2.64	75	2.84	108	2.45	78	2.75	111	2.86
El Salvador	83	68	110	2.71	2.48	2.93	52.9	107	2.37	114	2.25	76	2.82	83	2.66	76	2.78	74	3.29
Mozambique	84	70	110	2.68	2.48	2.89	52.2	88	2.49	116	2.24	58	3.06	109	2.44	79	2.75	97	3.04
Guyana	85	70	113	2.67	2.44	2.89	51.7	98	2.40	118	2.24	89	2.66	85	2.66	69	2.90	90	3.12
Morocco	86	56	137	2.67	2.25	3.08	51.6	124	2.22	90	2.46	54	3.09	91	2.59	122	2.34	83	3.20
Bangladesh	87	72	110	2.66	2.50	2.83	51.6	82	2.57	87	2.48	84	2.73	80	2.67	92	2.59	109	2.90
Ghana	88	72	110	2.66	2.48	2.84	51.5	93	2.46	86	2.48	85	2.71	98	2.54	101	2.52	82	3.21
Costa Rica	89	72	111	2.65	2.47	2.82	51.1	113	2.33	107	2.32	73	2.89	94	2.55	77	2.77	101	2.98

	LPI rank			LPI score				Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Lower bound	Upper bound	Score	Lower bound	Upper bound	% of highest performer	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Nigeria	90	74	112	2.63	2.46	2.80	50.5	92	2.46	96	2.40	118	2.43	74	2.74	82	2.70	95	3.04
Dominican Republic	91	74	111	2.63	2.46	2.79	50.4	101	2.39	111	2.29	87	2.67	79	2.68	88	2.63	93	3.06
Togo	92	70	130	2.62	2.35	2.88	50.1	89	2.49	117	2.24	93	2.62	106	2.46	91	2.60	76	3.24
Moldova	93	74	114	2.61	2.43	2.80	50.0	99	2.39	100	2.35	94	2.60	103	2.48	85	2.67	86	3.16
Colombia	94	74	113	2.61	2.43	2.79	50.0	129	2.21	95	2.43	103	2.55	81	2.67	96	2.55	78	3.23
Côte d'Ivoire	95	68	136	2.60	2.28	2.93	49.7	70	2.67	89	2.46	105	2.54	87	2.62	89	2.62	128	2.71
Iran, Islamic Rep.	96	68	137	2.60	2.26	2.94	49.6	110	2.33	72	2.67	88	2.67	82	2.67	111	2.44	116	2.81
Bosnia and Herzegovina	97	79	113	2.60	2.44	2.75	49.5	67	2.69	77	2.61	140	2.28	99	2.52	95	2.56	103	2.94
Comoros	98	72	136	2.58	2.31	2.85	49.0	75	2.63	98	2.36	98	2.58	88	2.60	113	2.44	115	2.82
Russian Federation	99	85	111	2.57	2.47	2.67	48.7	141	2.01	94	2.43	115	2.45	72	2.76	90	2.62	87	3.15
Niger	100	77	128	2.56	2.37	2.76	48.4	81	2.59	121	2.22	91	2.63	100	2.50	121	2.35	98	3.02
Paraguay	101	72	136	2.56	2.27	2.85	48.4	103	2.38	92	2.45	96	2.58	78	2.69	126	2.30	107	2.93
Nicaragua	102	78	136	2.53	2.31	2.75	47.5	90	2.48	83	2.50	107	2.50	96	2.55	107	2.47	134	2.68
Sudan	103	84	128	2.53	2.36	2.70	47.4	122	2.23	126	2.20	100	2.57	118	2.36	104	2.49	75	3.28
Maldives	104	82	136	2.51	2.30	2.73	46.9	102	2.39	81	2.57	132	2.34	111	2.44	102	2.49	110	2.88
Papua New Guinea	105	73	139	2.51	2.22	2.80	46.8	85	2.55	106	2.32	114	2.46	121	2.35	93	2.58	120	2.78
Macedonia, FYR	106	83	136	2.51	2.31	2.71	46.8	127	2.21	79	2.58	116	2.45	120	2.36	123	2.32	89	3.13
Burundi	107	80	136	2.51	2.28	2.74	46.8	137	2.02	147	1.98	119	2.42	107	2.46	83	2.68	63	3.45
Mongolia	108	84	136	2.51	2.31	2.70	46.7	100	2.39	140	2.05	129	2.37	129	2.31	108	2.47	65	3.40
Mali	109	82	136	2.50	2.28	2.73	46.6	94	2.45	109	2.30	112	2.48	105	2.46	120	2.36	106	2.93
Tunisia	110	74	139	2.50	2.21	2.78	46.4	147	1.96	93	2.44	133	2.33	90	2.59	84	2.67	99	3.00
Guatemala	111	85	136	2.48	2.28	2.67	45.8	91	2.47	127	2.20	120	2.41	130	2.30	110	2.46	100	2.98
Honduras	112	85	137	2.46	2.25	2.67	45.3	126	2.21	143	2.04	97	2.58	110	2.44	99	2.53	108	2.91
Myanmar	113	89	137	2.46	2.26	2.66	45.2	96	2.43	105	2.33	144	2.23	119	2.36	94	2.57	112	2.85
Zambia	114	95	137	2.43	2.26	2.60	44.3	119	2.25	113	2.26	106	2.51	114	2.42	119	2.36	124	2.74
Benin	115	98	136	2.43	2.27	2.59	44.3	130	2.20	97	2.39	104	2.55	104	2.47	129	2.23	130	2.69
Solomon Islands	116	85	144	2.42	2.16	2.67	43.9	79	2.60	124	2.21	139	2.28	112	2.43	132	2.18	121	2.76
Albania	117	95	139	2.41	2.22	2.60	43.8	121	2.23	148	1.98	110	2.48	102	2.48	135	2.15	94	3.05
Uzbekistan	118	89	145	2.40	2.16	2.65	43.5	114	2.32	91	2.45	130	2.36	116	2.39	143	2.05	114	2.83
Jamaica	119	102	136	2.40	2.27	2.53	43.4	109	2.37	120	2.23	117	2.44	126	2.31	116	2.38	136	2.64
Belarus	120	98	139	2.40	2.21	2.58	43.4	136	2.06	135	2.10	92	2.62	125	2.32	134	2.16	96	3.04
Trinidad and Tobago	121	102	137	2.40	2.26	2.53	43.3	104	2.38	104	2.34	137	2.31	132	2.28	127	2.28	119	2.79
Venezuela, RB	122	104	137	2.39	2.25	2.53	43.1	145	1.99	102	2.35	113	2.47	122	2.34	106	2.48	127	2.71
Montenegro	123	95	147	2.38	2.15	2.61	42.8	125	2.22	138	2.07	101	2.56	127	2.31	117	2.37	131	2.69
Nepal	124	87	150	2.38	2.09	2.66	42.7	149	1.93	112	2.27	109	2.50	140	2.13	109	2.47	104	2.93
Congo, Rep.	125	72	155	2.38	1.90	2.86	42.7	142	2.00	78	2.60	126	2.37	133	2.26	105	2.48	143	2.57
Ethiopia	126	98	145	2.38	2.16	2.59	42.7	80	2.60	133	2.12	102	2.56	117	2.37	133	2.18	149	2.37
Congo, Dem. Rep.	127	111	136	2.38	2.27	2.48	42.6	123	2.22	146	2.01	135	2.33	123	2.33	118	2.37	102	2.94
Guinea-Bissau	128	85	151	2.37	2.07	2.67	42.5	95	2.44	152	1.91	99	2.57	148	2.07	114	2.41	123	2.74
Guinea	129	97	150	2.36	2.12	2.60	42.1	117	2.28	145	2.01	124	2.38	97	2.54	97	2.54	148	2.38
Georgia	130	87	153	2.35	2.04	2.66	41.9	118	2.26	128	2.17	131	2.35	146	2.08	112	2.44	117	2.80
Cuba	131	98	150	2.35	2.10	2.59	41.7	105	2.38	108	2.31	136	2.31	135	2.25	124	2.31	145	2.51
Senegal	132	98	153	2.33	2.06	2.60	41.2	115	2.31	119	2.23	143	2.25	115	2.39	136	2.15	138	2.61
São Tomé and Príncipe	133	102	150	2.33	2.11	2.54	41.1	120	2.24	132	2.12	142	2.26	113	2.42	137	2.14	122	2.75

Economy	LPI rank			LPI score			% of highest performer	Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
	Rank	Lower bound	Upper bound	Score	Lower bound	Upper bound		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Djibouti	134	98	153	2.32	2.06	2.58	41.0	106	2.37	110	2.30	111	2.48	152	1.96	139	2.09	132	2.69
Bhutan	135	95	153	2.32	2.04	2.60	41.0	128	2.21	151	1.96	108	2.50	131	2.30	131	2.20	129	2.70
Fiji	136	95	155	2.32	2.02	2.61	40.8	111	2.33	115	2.25	147	2.21	134	2.25	128	2.25	140	2.60
Libya	137	102	155	2.26	1.98	2.55	39.2	153	1.88	142	2.04	123	2.40	101	2.50	153	1.85	113	2.83
Bolivia	138	118	150	2.25	2.10	2.40	38.8	146	1.97	134	2.11	122	2.40	154	1.90	125	2.31	118	2.79
Angola	139	123	150	2.24	2.10	2.38	38.5	157	1.80	129	2.13	128	2.37	128	2.31	130	2.21	141	2.59
Turkmenistan	140	99	157	2.21	1.84	2.58	37.6	143	2.00	103	2.34	127	2.37	145	2.09	154	1.84	142	2.59
Armenia	141	124	153	2.21	2.03	2.38	37.4	148	1.95	122	2.22	146	2.22	137	2.21	147	2.02	139	2.60
Liberia	142	119	155	2.20	2.01	2.40	37.3	135	2.07	144	2.01	145	2.22	147	2.07	140	2.07	125	2.73
Gabon	143	116	155	2.19	1.96	2.43	36.9	134	2.07	141	2.05	141	2.28	142	2.12	142	2.07	144	2.52
Eritrea	144	111	157	2.17	1.86	2.49	36.3	140	2.01	139	2.06	150	2.16	136	2.25	146	2.03	146	2.50
Chad	145	118	155	2.16	1.92	2.41	36.1	133	2.08	136	2.07	121	2.41	149	2.06	141	2.07	155	2.25
Kyrgyz Republic	146	105	157	2.16	1.80	2.51	35.8	156	1.80	150	1.96	152	2.10	151	1.96	115	2.39	126	2.72
Madagascar	147	132	155	2.15	1.97	2.34	35.8	112	2.33	131	2.12	149	2.17	153	1.93	148	2.01	151	2.35
Cameroon	148	131	155	2.15	1.95	2.35	35.7	132	2.09	125	2.21	155	1.98	124	2.32	145	2.04	154	2.29
Iraq	149	137	154	2.15	2.03	2.27	35.6	139	2.01	153	1.87	134	2.33	150	1.97	149	1.98	135	2.66
Afghanistan	150	137	155	2.14	2.02	2.27	35.4	138	2.01	154	1.84	125	2.38	139	2.15	155	1.77	137	2.61
Zimbabwe	151	122	157	2.08	1.77	2.40	33.6	144	2.00	123	2.21	153	2.08	141	2.13	150	1.95	158	2.13
Lao PDR	152	133	157	2.07	1.81	2.33	33.1	155	1.85	155	1.76	148	2.18	144	2.10	156	1.76	133	2.68
Tajikistan	153	138	156	2.06	1.87	2.26	32.9	150	1.93	130	2.13	151	2.12	143	2.12	144	2.04	159	2.04
Lesotho	154	118	159	2.03	1.65	2.41	31.8	151	1.91	149	1.96	158	1.84	138	2.16	151	1.92	150	2.35
Sierra Leone	155	130	159	2.03	1.70	2.36	31.8	152	1.91	137	2.07	138	2.31	155	1.85	157	1.74	156	2.23
Equatorial Guinea	156	140	160	1.88	1.53	2.23	27.3	154	1.88	158	1.50	156	1.89	157	1.75	152	1.89	153	2.32
Mauritania	157	140	160	1.87	1.52	2.21	26.8	131	2.14	157	1.54	154	2.00	158	1.74	159	1.54	157	2.14
Somalia	158	151	160	1.75	1.37	2.13	23.2	159	1.29	156	1.57	157	1.86	156	1.85	160	1.51	152	2.35
Haiti	159	156	160	1.72	1.55	1.88	22.2	158	1.70	159	1.47	159	1.81	159	1.68	158	1.56	160	2.02
Syrian Arab Republic	160	156	160	1.60	1.29	1.91	18.5	160	1.11	160	1.24	160	1.36	160	1.39	138	2.10	147	2.40

Note: The LPI index is a multidimensional assessment of logistics performance, rated on a scale from 1 (worst) to 5 (best). The six core components captured by the LPI survey are rated by respondents on a scale of 1–5, where 1 is very low or very difficult and 5 is very high or very easy, except for question 15, where 1 is hardly ever and 5 is nearly always. The relative LPI score is obtained by normalizing the LPI score: Percentage of highest performer = 100 × [LPI – 1] / [LPI highest – 1]. Thus, the best performer has the maximum relative LPI score of 100 percent.
Source: Logistics Performance Index 2016.

APPENDIX 2

Domestic LPI results, by region and income group

Percent of respondents

Question	Response categories	Region						Income group			
		East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa	Low income	Lower middle income	Upper middle income	High income
Question 17: Level of fees and charges											
Port charges	High or very high	42	51	52	53	49	70	67	56	54	49
	Low or very low	7	7	15	25	6	8	10	12	11	10
Airport charges	High or very high	50	43	42	45	33	53	44	43	51	43
	Low or very low	23	8	12	19	8	9	21	12	8	13
Road transport rates	High or very high	50	6	59	27	42	59	67	40	36	35
	Low or very low	19	50	13	29	12	3	2	17	27	20
Rail transport rates	High or very high	33	27	28	26	18	39	40	24	34	43
	Low or very low	22	28	43	50	33	18	20	31	33	18
Warehousing/transloading charges	High or very high	22	14	44	32	34	50	41	35	36	40
	Low or very low	11	36	18	14	19	10	17	17	17	23
Agent fees	High or very high	30	27	16	25	24	24	19	15	33	20
	Low or very low	22	38	20	27	39	25	35	34	17	26
Question 18: Quality of infrastructure											
Ports	Low or very low	35	29	45	35	25	33	43	26	38	19
	High or very high	23	27	21	33	18	25	24	24	27	54
Airports	Low or very low	31	10	20	34	36	30	22	30	25	14
	High or very high	37	48	22	35	25	23	21	28	36	55
Roads	Low or very low	45	36	53	32	53	39	37	44	41	14
	High or very high	20	24	12	24	5	18	17	18	19	45
Rail	Low or very low	54	49	86	64	63	61	61	53	72	44
	High or very high	21	22	3	20	3	17	17	18	12	25
Warehousing/transloading facilities	Low or very low	47	16	21	33	48	32	33	30	29	6
	High or very high	8	30	15	31	18	23	25	17	25	57
Telecommunications and IT	Low or very low	35	7	36	30	11	28	36	21	25	5
	High or very high	27	50	34	36	65	32	32	34	43	73
Question 19: Quality and competence of service											
Roads	Low or very low	33	24	49	10	27	30	36	32	24	9
	High or very high	27	35	17	34	16	22	14	27	29	58
Rail	Low or very low	53	35	74	67	50	59	62	54	58	33
	High or very high	21	16	4	11	4	16	15	13	12	33
Air transport	Low or very low	9	2	10	11	13	22	20	13	10	4
	High or very high	50	54	31	36	56	40	38	42	44	66
Maritime transport	Low or very low	21	11	7	1	14	20	16	12	13	6
	High or very high	48	55	34	43	51	42	36	46	46	62
Warehousing/transloading and distribution	Low or very low	25	16	28	20	30	17	23	19	21	4
	High or very high	23	46	34	38	26	25	20	27	41	63
Freight forwarders	Low or very low	11	10	10	11	13	6	6	6	13	3
	High or very high	37	58	31	49	53	47	48	47	43	75
Customs agencies	Low or very low	26	17	43	25	33	20	25	26	26	10
	High or very high	33	38	18	29	34	46	46	34	31	69
Quality/standards inspection agencies	Low or very low	30	24	45	37	32	27	37	33	28	15
	High or very high	25	31	16	25	25	21	16	22	27	53

Question	Response categories	Region						Income group			
		East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa	Low income	Lower middle income	Upper middle income	High income
Health/sanitary and phytosanitary agencies	Low or very low	48	36	53	38	43	31	40	38	40	23
	High or very high	23	25	18	25	20	20	21	18	25	43
Customs brokers	Low or very low	20	9	18	29	22	12	16	17	17	8
	High or very high	34	50	25	29	32	29	26	29	38	68
Trade and transport associations	Low or very low	25	21	34	32	33	25	28	24	29	20
	High or very high	21	33	32	21	28	23	18	26	31	49
Consignees or shippers	Low or very low	16	9	19	12	5	18	23	14	12	13
	High or very high	31	35	36	39	41	29	34	28	38	37
Question 20: Efficiency of processes											
Clearance and delivery of imports	Hardly ever or rarely	23	0	11	20	11	21	19	22	8	7
	Often or nearly always	56	71	71	53	64	46	48	47	71	85
Clearance and delivery of exports	Hardly ever or rarely	7	2	10	19	3	13	15	10	8	4
	Often or nearly always	77	86	76	64	85	59	60	67	78	91
Transparency of customs clearance	Hardly ever or rarely	33	11	19	35	26	20	24	27	17	9
	Often or nearly always	55	48	57	52	35	54	51	43	60	81
Transparency of other border agencies	Hardly ever or rarely	35	12	20	31	27	22	27	24	20	10
	Often or nearly always	48	49	53	55	35	40	42	44	49	74
Provision of adequate and timely information on regulatory changes	Hardly ever or rarely	25	19	42	33	34	31	36	28	30	15
	Often or nearly always	49	41	28	42	46	44	39	43	40	66
Expedited customs clearance for traders with high compliance levels	Hardly ever or rarely	31	17	18	28	23	32	30	32	19	14
	Often or nearly always	50	41	43	50	46	31	28	36	50	65
Question 21: Sources of major delays											
Compulsory warehousing/ transloading	Often or nearly always	10	15	32	35	20	26	23	24	25	7
	Hardly ever or rarely	49	54	42	40	33	38	39	41	45	69
Preshipment inspection	Often or nearly always	10	6	34	33	21	23	25	22	21	10
	Hardly ever or rarely	27	66	32	42	29	41	39	39	45	69
Maritime transshipment	Often or nearly always	13	18	26	22	28	24	32	20	19	8
	Hardly ever or rarely	27	56	45	28	32	29	25	38	40	55
Criminal activities (such as stolen cargo)	Often or nearly always	18	8	15	13	22	11	16	13	11	5
	Hardly ever or rarely	64	79	43	64	51	61	62	62	60	83
Solicitation of informal payments	Often or nearly always	20	9	34	28	40	25	26	28	22	5
	Hardly ever or rarely	47	64	40	44	25	34	26	39	52	78

Question	Response categories	Region						Income group			
		East Asia and Pacific	Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa	Low income	Lower middle income	Upper middle income	High income
Question 22: Changes in the logistics environment since 2013											
Customs clearance procedures	Much worsened or worsened	8	9	29	51	9	7	2	26	18	11
	Improved or much improved	78	63	31	28	68	68	76	51	50	59
Other official clearance procedures	Much worsened or worsened	7	13	25	60	4	14	11	19	29	11
	Improved or much improved	67	53	26	24	45	54	62	41	41	51
Trade and transport infrastructure	Much worsened or worsened	9	4	16	21	13	10	5	16	12	9
	Improved or much improved	71	56	46	40	54	47	51	51	49	53
Telecommunications and IT infrastructure	Much worsened or worsened	7	0	3	11	1	9	8	7	5	7
	Improved or much improved	74	73	65	40	82	60	56	57	71	70
Private logistics services	Much worsened or worsened	1	0	10	13	11	5	5	6	7	2
	Improved or much improved	80	80	50	46	76	61	62	61	65	63
Regulation related to logistics	Much worsened or worsened	6	21	31	45	25	13	12	24	26	13
	Improved or much improved	63	41	32	22	46	43	44	42	36	31
Solicitation of informal payments	Much worsened or worsened	5	14	29	37	25	19	18	20	25	6
	Improved or much improved	50	40	28	18	48	43	43	35	36	35

Note: Responses are calculated at the country level and then averaged by region and income group.
Source: Logistics Performance Index 2016.

APPENDIX 3

Domestic LPI results, time and cost data

	Question 24: Export time and cost				Question 25: Import time and cost			
	Port or airport supply chain[a]		Land supply chain[b]		Port or airport supply chain[c]		Land supply chain[b]	
Economy	Distance[d] (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)
Albania			750	3			750	3
Algeria	112	4			474	5	150	1
Angola	25	14			25	14	2,000	10
Argentina	94	2	1,250	7	132	4	1,250	7
Australia	25	1	25	3	25	2	25	3
Austria	207	2	555	3	155	2	527	2
Bangladesh	339	4	304	7	345	5	253	7
Belarus	75	2	1,581	7	750	4	1,710	8
Belgium	83	2	334	4	167	3	276	2
Benin	292	3	909	7	211	2	177	2
Bolivia	1,250	12	1,250	6	612	13	2,000	8
Bosnia and Herzegovina	57	1	256	2	403	3	655	4
Brazil	173	3	415	8	281	4	944	20
Bulgaria	300	1	1,800	4	300	2	880	4
Burkina Faso	474	5	3,500	42	3,500	4	3,500	39
Burundi	230	7	689	12	1,841	15	388	9
Cambodia	87	3	178	5	87	4	407	6
Cameroon	25	8	1,040	11	224	9	339	12
Canada	100	2	401	4	87	2	388	4
Chad	2,092	22	2,092	24	2,092	24	1,250	7
China	130	3	402	6	187	5	649	9
Colombia	109	4	474	3	178	3	300	7
Congo, Dem. Rep.	612	8	300	18	612	7	612	7
Congo, Rep.	296	12	2,000	18	464	12	3,500	14
Costa Rica	150	3	75	3	119	4		
Côte d'Ivoire	25	2			25	10		
Cuba	75	6	300	10	75	7		
Cyprus	43	1	512	5	43	1	296	4
Czech Republic	750	5	2,000	5	750	5	1,250	5
Denmark	25	1	25	1	75	1	75	1
Djibouti	41	2	238	4	117	3	423	6
Dominican Republic	52	4	75	2	36	4	75	4
Ecuador	43	1	25		43	3		
Egypt, Arab Rep.	300	2	3,500	1	452	3	2,092	2
Estonia			775	4			2,000	5
Ethiopia			750	6			750	3
Finland	113	2	1,157	5	135	2	1,263	4
France					25			
Gambia, The	25	1	25	1	25	1	25	1
Georgia	87	2	87	2	296	2	224	5
Germany	259	3	631	3	285	3	1,043	4
Ghana	260	3	625	4	199	4	276	6
Greece	83	3	1,647	6	83	3	1,647	6

	Question 24: Export time and cost				Question 25: Import time and cost			
	Port or airport supply chain[a]		Land supply chain[b]		Port or airport supply chain[c]		Land supply chain[b]	
Economy	Distance[d] (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)
Guatemala	57	2	612	3	131	3	612	3
Haiti	25	2			25	2		
Honduras	149	4	3,500	9	301	7	1,581	8
Hong Kong SAR, China	138	3	446	5	101	3	143	3
Hungary			300	3			300	3
India	231	4	729	6	322	5	473	6
Indonesia	133	3	145	3	126	5	165	5
Iran, Islamic Rep.	108	2	177	2	33	3	156	4
Iraq	300	39	2,000	46	300	7	2,000	14
Ireland	87	2	750	3	43	2	750	4
Israel	300	1			300	2		
Italy	279	2	368	4	238	3	302	4
Jamaica	25	3	25	3	25	3	25	3
Japan	43	2	1,250	7	43	3		
Jordan	1,250	2			300	7		
Kazakhstan	25	3	478	9	25	3	403	8
Kenya	145	3	496	5	262	3	439	6
Korea, Rep.	1,250	2	75	2	2,000	3	75	2
Kuwait	25	2			75	1	75	2
Latvia	25	1	1,800	3	25	1	2,000	3
Lebanon	25	1			25	1		
Liberia	300	7	750	10	300	7	750	10
Libya	25	11			25	4		
Lithuania	332	2	1,107	4	399	3	1,392	5
Luxembourg	67	2	407	2	130	2	133	2
Macedonia, FYR	105	2	760	2	183	2	633	2
Madagascar		3						
Malawi	1,250		1,250	25				
Malaysia	75	3			300	7		
Maldives	43	6	75	10	83	9	119	10
Malta	25	1	66	3	25	1	25	2
Mauritania	3,500	13	3,500	6	2,000	32		
Mauritius	25	2	25	2	25	2	25	2
Mexico	255	2	1,690	5	219	3	1,601	4
Moldova	3,500	25	1,250	3	3,500	32	1,250	3
Mongolia	86	4	1,181	16	75	4	772	12
Morocco	186	4	2,000	6	202	5	1,432	8
Namibia	364	3	1,558	5	613	3	2,092	5
Netherlands	218	3	414	2	184	2	226	2
Niger	25	1			750	12		
Nigeria	177	3	447	4	155	3	358	4
Norway	750	2	1,250	4			1,250	3
Oman	300	2	474	3	150	2	474	3
Pakistan	264	4	576	7	391	5	562	6
Panama	75	4	300	10	75	4	300	6
Peru	25	2	25	2	25	1	25	1
Philippines	64	3	241	10	61	7	300	9

	Question 24: Export time and cost				Question 25: Import time and cost			
	Port or airport supply chain[a]		Land supply chain[b]		Port or airport supply chain[c]		Land supply chain[b]	
Economy	Distance[d] (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)	Distance (kilometers)	Lead time (days)
Poland	300	1	1,054	4	300	1	612	2
Portugal	87	2	1,025	21	296	8	1,620	20
Qatar	48	4	2,094	7	133	3	1,620	5
Romania	377	3	701	3	212	3	1,024	4
Russian Federation	617	5	1,012	5	668	7	2,646	14
Rwanda	440	2	1,006	3	510	3	881	6
Saudi Arabia	47	3	108	2	104	7	595	13
Senegal	1,543	6	1,095	6	297	3	297	4
Serbia	43	1	1,250	4	43	2	750	3
Singapore	31	2	44	2	35	2	107	2
Slovak Republic			1,486	5			889	4
Slovenia	323	2	393	2	325	2	393	2
South Africa	278	3	1,281	6	224	3	730	4
Spain	83	3	750	3	149	4		
Sri Lanka	70	1	95	4	43	2	33	2
Sudan	1,233	11	1,872	18	924	12	1,673	16
Sweden			968	3			750	3
Switzerland	75	1	750	5	75	2	750	5
Syrian Arab Republic	300	1	300	1	1,250	5	1,250	5
Taiwan, China	111	1	349	2	166	1	646	2
Tanzania	46	4	234	6	79	4	322	7
Thailand	25	1	25	2	25	1	25	2
Togo	33	2	286	5	25	3	177	6
Trinidad and Tobago	750	7			750	7		
Tunisia	113	3	621	5	109	3	1,004	9
Turkey	121	2	1,118	5	119	2	574	4
Uganda	710	5	2,483	8	787	6	1,250	4
Ukraine	923	3	2,904	8	750	2	2,092	5
United Arab Emirates	70	2	307	3	107	2	265	2
United Kingdom	387	2	634	3	357	3	653	4
United States	427	3	1,081	4	237	3	483	4
Uruguay	78	4	512	3	52	3	3,500	2
Uzbekistan	296	18	25	10	512	20	387	12
Vietnam	141	3	249	3	102	3	230	3
Yemen, Rep.	1,250	3	1,250	5	1,250	7	1,250	7
Zambia	445	9	1,432	13	155	6	1,245	12
Zimbabwe	760	5	2,381	9	941	10	2,706	34

a. From the point of origin (the seller's factory, typically located either in the capital city or in the largest commercial center) to the port of loading or equivalent (port/airport), and excluding international shipping (EXW to FOB).
b. From the point of origin (the seller's factory, typically located either in the capital city or in the largest commercial center) to the buyer's warehouse (EXW to DDP).
c. From the port of discharge or equivalent to the buyer's warehouse (DAT to DDP).
d. Aggregates of the distance indicator for port and airport.
Source: Logistics Performance Index 2016.

Economy	Question 26: % of shipments meeting quality criteria	Question 27: Number of agencies		Question 28: Number of forms		Question 29: Clearance time (days)[a]		Question 31: Physical inspection	Question 32: Multiple inspection
	% of shipments	Imports	Exports	Imports	Exports	Without physical inspection	With physical inspection	% of import shipments	% of shipments physically inspected
Albania	93	1	1	4	4	0	1	6	3
Algeria	53	3	3	3	3	3	6	75	50
Angola	88	5	5	7	7	6	10	35	1
Argentina	84	6	4	6	4	1	4	28	4
Armenia		3	5	6	7				
Australia	93	2	1	7	3	2	4	3	1
Austria	96	1	1	2	2	0	1	2	1
Bangladesh	65	4	3	5	4	2	3	30	12
Belarus	92	5	4	4	4	1	2	6	1
Belgium	79	1	1	2	2	1	2	2	1
Benin	59	4	3	2	2	1	1	5	9
Bolivia	40	3	2	9	10	3	35	18	1
Bosnia and Herzegovina	68	2	1	3	3	0	1	11	3
Brazil	90	3	3	3	3	3	4	6	2
Brunei Darussalam									
Bulgaria	91	2	2	3	3	1	1	16	1
Burkina Faso	90	5	5	6	6	2	4	11	1
Burundi	52	5	4	3	4	3	4	19	10
Cambodia	92	2	2	4	4	2	2	21	10
Cameroon	58	6	7	9	9	3	4	29	21
Canada	89	3	2	2	2	0	3	3	1
Chad	61	4	4	6	4	8	5	11	9
China	72	3	3	5	4	2	3	10	3
Colombia	95	4	4	5	4	3	5	5	6
Congo, Dem. Rep.	40	7	7	6	6	5	6	75	61
Congo, Rep.	59	6	6	2	3	2	3	33	11
Costa Rica	51	2	2	3	2	1	4	9	3
Côte d'Ivoire		2	2			1	2	6	1
Cuba	83	3	3	2	2	5	8	35	6
Cyprus	92	1	1	1	1	1	1	22	9
Czech Republic	40	1	1	2	2	0	1	11	6
Denmark	97	1	1	1	1	0	1	3	3
Djibouti	80	3	3	3	3	1	1	8	5
Dominican Republic	89	3	3	4	4	2	3	20	6
Ecuador	92	4	3	4	3	1	1	2	1
Egypt, Arab Rep.	75	5	3	5	4	2	2	27	4
Estonia	93	1	1	1	1	1	1	1	1
Ethiopia	83	7	4	7	5	2	3	5	8
Finland	93	1	1	1	1	0	1	2	1
France						1	2	3	
Gambia, The	88	7		7		1	1	1	
Georgia	57	1	1	3	3	0	1	3	1
Germany	94	2	2	2	2	1	2	3	2
Ghana	82	6	6	6	5	2	2	33	6
Greece	92	1	1	2	2	1	1	9	4

Economy	Question 26: % of shipments meeting quality criteria	Question 27: Number of agencies		Question 28: Number of forms		Question 29: Clearance time (days)[a]		Question 31: Physical inspection	Question 32: Multiple inspection
	% of shipments	Imports	Exports	Imports	Exports	Without physical inspection	With physical inspection	% of import shipments	% of shipments physically inspected
Guatemala	57	3	3	4	4	3	4	36	6
Haiti	40	3	3	2	2	7	10	6	1
Honduras	74	3	3	3	3	1	3	21	3
Hong Kong SAR, China	89	3	3	3	4	1	2	3	3
Hungary	97	1	1	1	1	1	1	3	1
India	69	3	4	5	5	2	3	22	4
Indonesia	80	2	2	4	3	2	4	5	2
Iran, Islamic Rep.	65	5	5	6	5	3	4	39	20
Iraq	40	3	5	6	6	3	6	75	75
Ireland	95	1	1	1	1	0	2	1	1
Israel	95	5	3	3	2	0	1	3	1
Italy	91	2	2	3	2	1	2	4	2
Jamaica	93	4	4	4	5	1	4	50	50
Japan	62	3	3	2	1	1	2	1	1
Jordan	83	4	3	4	4	2	3	14	3
Kazakhstan	89	2	2	3	3	1	2	5	2
Kenya	77	5	4	5	4	2	2	40	10
Korea, Rep.	97	2	1	4	2	1	2	18	18
Kuwait	83	3	1	1	1	3	3	75	1
Latvia	93	2	2	2	2	0	2	8	2
Lebanon	96	1	2	2	3	1	2	61	18
Liberia		5	7	4	4	1	2	3	3
Libya	83	4	3	5	4	4	7	35	35
Lithuania	92	2	2	2	2	0	1	3	2
Luxembourg	85	1	1	1	2	0	1	3	2
Macedonia, FYR	79	2	2	3	2	1	1	8	3
Madagascar	83	10	10	5	5	2	7	6	6
Malawi		2	3	7	7	5	6	14	9
Malaysia	83								
Maldives	59	3	3	3	3	2	2	13	12
Malta	85	1	1	1	1	1	1	5	2
Mauritania	40	1	2	2	1	0	1	50	18
Mauritius	94	5	4	2	2	1	2	6	1
Mexico	79	3	2	4	3	1	2	9	3
Moldova	88	3	4	3	4	1	2	18	6
Mongolia	88	3	4	3	4	1	1	27	9
Morocco	80	3	2	4	4	2	2	10	3
Namibia	90	2	2	3	3	2	4	7	2
Netherlands	88	1	1	2	1	0	1	2	1
Niger	83	4	4	1	1	1	1	18	6
Nigeria	62	8	7	8	6	3	4	49	13
Norway	93	1	1	1	1	0	1	1	1
Oman	40	4	4	3	3	1	2	11	3
Pakistan	68	4	4	3	3	2	3	22	10
Panama		3	2	2	1	1	3	18	1

Economy	Question 26: % of shipments meeting quality criteria	Question 27: Number of agencies		Question 28: Number of forms		Question 29: Clearance time (days)[a]		Question 31: Physical inspection	Question 32: Multiple inspection
	% of shipments	Imports	Exports	Imports	Exports	Without physical inspection	With physical inspection	% of import shipments	% of shipments physically inspected
Peru	83	2	3	1	2	1	1	35	1
Philippines	58	5	5	5	5	3	7	21	3
Poland	95	1	1	1	1	1	1	11	7
Portugal	88	2	1	2	2	1	2	16	4
Qatar	76	5	5	3	3	1	2	32	14
Romania	90	1	1	2	2	1	1	3	1
Russian Federation	55	2	3	4	5	3	5	22	6
Rwanda	79	6	5	6	5	1	1	45	14
Saudi Arabia	65	2	2	3	2	2	4	62	6
Senegal	52	3	3	3	4	1	2	39	7
Serbia	92	1	1	2	2	1	1	3	1
Singapore	87	2	2	1	1	0	1	1	1
Slovak Republic	97	1	1	2	2	0	1	1	1
Slovenia	92	2	2	3	2	0	1	4	1
South Africa	76	2	2	3	2	1	4	4	2
Spain	91	3	2	4	3	1	1	5	3
Sri Lanka	78	3	3	4	3	1	2	37	13
Sudan	68	5	5	5	5	3	5	34	48
Sweden	95	1	1	1	1	0	1	2	2
Switzerland	97	1	1	2	2	0	0	1	1
Syrian Arab Republic		2	2	1	1	1	2	50	18
Taiwan, China	96	3	3	4	4	0	1	3	1
Tanzania	82	6	6	5	5	2	4	61	15
Thailand	93	1	1	2	1	1	2	1	1
Togo	65	3	3	3	3	2	2	19	3
Trinidad and Tobago	40	3	3	6		10	14	50	50
Tunisia	61	4	3	4	3	3	4	66	12
Turkey	68	3	2	3	3	1	2	7	3
Uganda	59	4	5	6	5	2	4	51	10
Ukraine	92	4	4	5	5	1	1	4	3
United Arab Emirates	82	3	3	3	3	1	1	14	4
United Kingdom	88	2	1	2	1	1	1	4	2
United States	96	3	2	3	3	1	2	4	3
Uruguay	91	1	1	1	1	1	2	3	1
Uzbekistan	61	3	3	5	5	4	9	14	9
Vietnam	57	4	3	4	3	1	3	17	9
Yemen, Rep.	93	4	4	3	3		3		
Zambia	86	3	3	4	2	3	4	21	2
Zimbabwe	73	5	6	5	5	1	3	35	5

a. Time taken between the submission of an accepted customs declaration and notification of clearance.
Source: Logistics Performance Index 2016.

APPENDIX 4

LPI results across four editions (2010, 2012, 2014, and 2016)

Scores of the six components across the five LPI surveys were used to generate a big picture to indicate countries' logistics performance more accurately. This approach reduces random variation from one LPI survey to another and enables the comparison of 167 countries. Each year's scores in each component were given weights: 6.7 percent for 2010, 13.3 percent for 2012, 26.7 percent for 2014, and 53.3 percent for 2016. In this way, the most recent data carry the highest weight.

	LPI		Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score
Germany	1	4.17	2	4.07	1	4.38	7	3.79	1	4.20	1	4.21	2	4.41
Netherlands	2	4.12	3	4.03	2	4.25	6	3.83	2	4.17	6	4.13	5	4.36
Singapore	3	4.10	1	4.11	3	4.22	4	3.89	5	4.06	9	4.02	6	4.35
Sweden	4	4.08	9	3.84	4	4.19	5	3.84	3	4.13	2	4.19	4	4.37
Luxembourg	5	4.08	8	3.84	10	4.08	1	4.02	13	3.90	14	3.96	1	4.68
Belgium	6	4.06	10	3.82	11	4.07	3	3.89	4	4.07	3	4.17	3	4.38
United Kingdom	7	4.02	5	3.92	6	4.14	8	3.70	6	4.02	7	4.10	7	4.32
Hong Kong SAR, China	8	4.00	7	3.88	12	4.06	2	3.92	10	3.95	11	3.99	9	4.21
United States	9	3.95	15	3.73	5	4.16	21	3.55	7	3.99	4	4.17	10	4.21
Japan	10	3.95	12	3.81	8	4.12	14	3.63	8	3.97	10	4.02	8	4.22
Austria	11	3.93	16	3.70	15	3.93	9	3.67	9	3.97	5	4.16	12	4.19
Switzerland	12	3.92	6	3.88	7	4.12	16	3.60	14	3.89	15	3.96	13	4.16
Canada	13	3.90	13	3.79	9	4.09	28	3.51	12	3.91	8	4.03	16	4.12
France	14	3.88	17	3.68	14	4.00	12	3.64	18	3.80	13	3.98	11	4.21
Finland	15	3.86	4	3.96	17	3.90	22	3.55	15	3.88	16	3.86	21	4.04
Denmark	16	3.84	11	3.81	19	3.82	11	3.65	11	3.94	24	3.70	17	4.12
Norway	17	3.80	14	3.74	13	4.02	26	3.53	16	3.83	22	3.74	24	4.01
Australia	18	3.79	19	3.64	18	3.86	18	3.58	17	3.82	17	3.85	20	4.04
United Arab Emirates	19	3.79	18	3.67	16	3.92	13	3.64	23	3.71	19	3.78	18	4.06
Ireland	20	3.78	20	3.56	22	3.73	10	3.66	20	3.80	12	3.98	25	4.00
Italy	21	3.72	24	3.41	20	3.78	19	3.58	22	3.71	18	3.83	19	4.04
Spain	22	3.71	21	3.51	23	3.73	20	3.57	21	3.74	21	3.74	22	4.03
Taiwan, China	23	3.70	27	3.35	25	3.62	15	3.61	19	3.80	25	3.69	14	4.15
Korea, Rep.	24	3.70	23	3.45	21	3.77	23	3.55	25	3.67	20	3.75	23	4.01
South Africa	25	3.65	25	3.41	26	3.60	24	3.54	24	3.68	23	3.73	27	3.95
China	26	3.60	32	3.27	24	3.70	17	3.59	26	3.55	28	3.60	32	3.88
Czech Republic	27	3.54	26	3.39	34	3.28	25	3.53	27	3.55	26	3.66	34	3.83
Israel	28	3.50	28	3.32	31	3.41	45	3.16	28	3.51	30	3.52	15	4.14
Qatar	29	3.50	30	3.31	30	3.43	29	3.44	29	3.44	34	3.47	31	3.88
Malaysia	30	3.48	35	3.23	29	3.48	27	3.52	31	3.39	31	3.49	37	3.76
New Zealand	31	3.48	22	3.45	27	3.56	51	3.12	34	3.33	29	3.52	28	3.94
Portugal	32	3.46	29	3.32	36	3.21	35	3.30	33	3.36	27	3.64	30	3.91
Poland	33	3.45	34	3.26	44	3.12	30	3.43	32	3.39	35	3.46	26	3.97
Turkey	34	3.44	37	3.17	28	3.49	32	3.33	30	3.42	33	3.49	38	3.76
Lithuania	35	3.39	36	3.18	33	3.28	36	3.30	39	3.24	38	3.39	29	3.92
Hungary	36	3.37	47	2.97	32	3.33	33	3.32	36	3.29	32	3.49	33	3.84

	LPI		Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score
Iceland	37	3.35	31	3.30	42	3.18	41	3.22	35	3.33	39	3.39	39	3.71
Thailand	38	3.29	40	3.11	39	3.20	34	3.32	42	3.16	45	3.28	40	3.69
Estonia	39	3.28	33	3.27	43	3.14	52	3.12	43	3.15	49	3.18	36	3.80
Latvia	40	3.27	42	3.08	48	3.06	39	3.24	41	3.16	37	3.39	42	3.67
Slovak Republic	41	3.27	41	3.09	41	3.19	37	3.28	44	3.13	56	3.08	35	3.82
India	42	3.26	46	2.97	45	3.12	38	3.25	38	3.24	42	3.33	45	3.65
Slovenia	43	3.23	48	2.95	37	3.20	53	3.10	37	3.27	43	3.32	49	3.56
Chile	44	3.23	38	3.16	57	2.94	43	3.18	50	3.03	36	3.40	44	3.65
Panama	45	3.22	43	3.04	46	3.12	31	3.36	52	3.03	55	3.08	41	3.68
Bahrain	46	3.22	39	3.11	47	3.10	44	3.17	40	3.23	40	3.35	65	3.37
Saudi Arabia	47	3.16	58	2.76	35	3.26	54	3.10	49	3.05	48	3.22	48	3.58
Greece	48	3.16	50	2.90	40	3.19	65	2.93	55	2.96	41	3.34	43	3.66
Mexico	49	3.11	57	2.77	56	2.95	59	3.05	46	3.11	44	3.29	58	3.46
Croatia	50	3.11	45	3.01	54	2.98	60	3.05	48	3.07	53	3.13	64	3.39
Oman	51	3.10	53	2.82	38	3.20	42	3.22	53	3.02	65	2.89	61	3.43
Kuwait	52	3.08	54	2.80	50	3.00	40	3.23	64	2.84	50	3.16	60	3.44
Malta	53	3.07	52	2.83	51	3.00	48	3.12	56	2.91	57	3.08	55	3.47
Brazil	54	3.06	70	2.62	49	3.05	68	2.90	45	3.11	46	3.24	57	3.46
Egypt, Arab Rep.	55	3.06	63	2.71	55	2.96	56	3.08	47	3.09	54	3.09	63	3.41
Romania	56	3.05	51	2.87	62	2.76	47	3.13	57	2.91	58	3.08	51	3.53
Cyprus	57	3.04	44	3.02	53	2.98	64	2.93	63	2.84	70	2.84	47	3.61
Vietnam	58	3.03	59	2.75	59	2.80	46	3.15	58	2.91	60	3.00	53	3.51
Kenya	59	3.02	68	2.64	60	2.78	50	3.12	59	2.91	51	3.14	52	3.51
Indonesia	60	2.99	65	2.70	66	2.70	70	2.90	54	3.00	52	3.13	54	3.50
Argentina	61	2.99	72	2.58	58	2.85	66	2.91	60	2.88	47	3.23	56	3.47
Bulgaria	62	2.96	74	2.58	74	2.62	55	3.08	51	3.03	71	2.84	50	3.53
Uganda	63	2.94	49	2.91	82	2.56	63	2.94	72	2.77	78	2.75	46	3.62
Philippines	64	2.94	62	2.72	77	2.60	49	3.12	65	2.84	61	2.98	68	3.30
Uruguay	65	2.88	64	2.70	64	2.71	75	2.83	61	2.86	67	2.87	69	3.29
Peru	66	2.88	67	2.65	69	2.67	69	2.90	68	2.83	63	2.91	70	3.28
Brunei Darussalam	67	2.87	55	2.78	63	2.75	61	3.00	97	2.57	64	2.91	76	3.19
Jordan	68	2.87	82	2.51	68	2.68	57	3.07	70	2.78	75	2.78	67	3.32
Pakistan	69	2.86	66	2.69	70	2.65	62	2.96	73	2.77	74	2.81	75	3.22
Morocco	70	2.84	99	2.42	61	2.78	58	3.05	75	2.73	89	2.65	66	3.34
Botswana	71	2.82	56	2.78	67	2.69	91	2.66	81	2.66	81	2.71	62	3.42
Serbia	72	2.82	96	2.43	81	2.56	74	2.83	66	2.84	62	2.93	71	3.27
Malawi	73	2.81	61	2.73	52	2.99	87	2.70	62	2.86	92	2.62	99	3.01
Ukraine	74	2.81	101	2.40	80	2.56	84	2.72	80	2.67	59	3.02	59	3.45
Bahamas, The	75	2.79	60	2.73	65	2.71	76	2.82	71	2.78	88	2.65	93	3.04
Rwanda	76	2.77	69	2.63	106	2.38	72	2.86	89	2.63	68	2.86	78	3.18
El Salvador	77	2.76	80	2.52	102	2.39	73	2.84	69	2.79	73	2.81	82	3.14
Ecuador	78	2.76	77	2.54	87	2.49	71	2.89	87	2.64	87	2.66	72	3.26
Tanzania	79	2.74	81	2.51	78	2.57	79	2.78	85	2.65	84	2.69	74	3.23
Lebanon	80	2.74	73	2.58	75	2.61	82	2.74	86	2.65	66	2.89	103	2.98
Kazakhstan	81	2.74	91	2.46	73	2.63	80	2.76	88	2.63	69	2.84	89	3.08
Cambodia	82	2.72	75	2.56	104	2.38	67	2.91	96	2.59	76	2.76	88	3.08

	LPI		Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score
Dominican Republic	83	2.71	89	2.47	96	2.42	81	2.76	74	2.73	80	2.72	84	3.13
Costa Rica	84	2.69	108	2.38	99	2.40	78	2.80	84	2.65	72	2.82	90	3.07
Bosnia and Herzegovina	85	2.69	71	2.59	76	2.60	111	2.57	92	2.62	94	2.60	79	3.18
Sri Lanka	86	2.68	79	2.52	123	2.24	103	2.62	67	2.84	82	2.71	87	3.08
Colombia	87	2.66	106	2.39	88	2.48	102	2.62	77	2.71	97	2.58	77	3.18
Algeria	88	2.66	98	2.42	92	2.46	85	2.71	82	2.66	85	2.68	96	3.02
Namibia	89	2.66	86	2.49	72	2.64	99	2.63	94	2.61	101	2.54	94	3.04
Côte d'Ivoire	90	2.66	85	2.50	95	2.42	90	2.67	90	2.63	79	2.74	107	2.96
Bangladesh	91	2.65	104	2.39	105	2.38	77	2.81	93	2.62	99	2.57	86	3.09
Nigeria	92	2.65	115	2.35	94	2.43	115	2.53	78	2.68	77	2.76	81	3.14
Tunisia	93	2.62	137	2.16	91	2.47	101	2.63	95	2.60	86	2.67	80	3.18
Paraguay	94	2.62	100	2.41	93	2.44	100	2.63	79	2.67	104	2.52	98	3.02
Ghana	95	2.62	112	2.37	89	2.48	86	2.71	103	2.51	95	2.59	97	3.02
Burkina Faso	96	2.62	93	2.46	86	2.50	105	2.59	91	2.62	115	2.46	91	3.07
Guatemala	97	2.62	76	2.56	109	2.35	110	2.57	105	2.49	96	2.58	85	3.12
Russian Federation	98	2.61	152	2.07	90	2.47	114	2.54	76	2.72	83	2.70	83	3.14
Moldova	99	2.58	113	2.36	100	2.40	88	2.69	117	2.40	98	2.57	95	3.03
Maldives	100	2.57	83	2.51	85	2.53	118	2.52	98	2.55	102	2.53	130	2.79
Mauritius	101	2.57	117	2.33	84	2.53	94	2.65	104	2.50	120	2.42	106	2.96
Nicaragua	102	2.56	88	2.48	107	2.37	108	2.58	100	2.51	108	2.51	113	2.91
Albania	103	2.56	123	2.30	137	2.17	97	2.64	99	2.54	127	2.37	73	3.26
Iran, Islamic Rep.	104	2.55	127	2.27	83	2.55	107	2.58	83	2.66	112	2.47	132	2.78
Benin	105	2.54	107	2.38	98	2.41	109	2.58	101	2.51	118	2.43	110	2.93
Guyana	106	2.54	111	2.37	120	2.25	116	2.53	106	2.48	90	2.64	109	2.93
Venezuela, RB	107	2.53	141	2.11	101	2.40	96	2.64	109	2.47	91	2.63	111	2.92
Niger	108	2.53	78	2.54	126	2.22	104	2.60	114	2.43	125	2.38	105	2.97
Macedonia, FYR	109	2.53	126	2.27	79	2.56	121	2.48	108	2.47	122	2.40	101	3.00
Honduras	110	2.53	110	2.38	138	2.15	92	2.66	111	2.46	100	2.55	108	2.94
Togo	111	2.53	114	2.35	131	2.19	98	2.64	126	2.35	93	2.61	102	2.99
Jamaica	112	2.53	92	2.46	103	2.39	112	2.55	116	2.41	105	2.52	125	2.82
Montenegro	113	2.52	105	2.39	111	2.33	89	2.67	125	2.36	107	2.51	120	2.85
Belarus	114	2.51	132	2.21	108	2.36	95	2.65	115	2.42	136	2.34	100	3.01
Mozambique	115	2.48	119	2.32	134	2.18	83	2.74	131	2.30	111	2.48	123	2.83
Georgia	116	2.47	116	2.34	112	2.33	133	2.41	132	2.30	106	2.52	115	2.91
São Tomé and Príncipe	117	2.47	122	2.31	117	2.27	124	2.46	112	2.44	103	2.53	133	2.76
Azerbaijan	118	2.47	94	2.46	71	2.64	106	2.58	155	2.17	145	2.26	142	2.70
Comoros	119	2.46	87	2.49	121	2.25	125	2.46	113	2.44	121	2.41	141	2.71
Papua New Guinea	120	2.46	102	2.40	118	2.25	126	2.45	127	2.35	110	2.48	122	2.83
Senegal	121	2.46	97	2.42	114	2.29	113	2.55	107	2.47	135	2.34	144	2.66
Solomon Islands	122	2.46	84	2.51	119	2.25	150	2.28	110	2.46	133	2.34	118	2.87
Mali	123	2.45	125	2.28	127	2.21	120	2.50	130	2.33	117	2.44	112	2.92
Uzbekistan	124	2.44	138	2.16	113	2.31	141	2.36	122	2.39	123	2.39	104	2.98
Guinea	125	2.42	120	2.32	149	2.08	128	2.44	102	2.51	109	2.50	149	2.63
Ethiopia	126	2.42	95	2.44	144	2.12	117	2.53	121	2.39	132	2.35	151	2.62
Mongolia	127	2.41	129	2.25	143	2.13	134	2.41	140	2.25	131	2.35	92	3.05

	LPI		Customs		Infrastructure		International shipments		Logistics quality and competence		Tracking and tracing		Timeliness	
Economy	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score
Zambia	128	2.41	121	2.31	132	2.19	137	2.39	128	2.35	124	2.39	126	2.81
Central African Republic	129	2.40	90	2.47	97	2.42	157	2.20	123	2.39	134	2.34	145	2.65
Armenia	130	2.40	135	2.18	115	2.29	130	2.43	118	2.40	146	2.24	124	2.83
Trinidad and Tobago	131	2.40	109	2.38	110	2.34	148	2.31	135	2.28	142	2.28	128	2.79
Guinea-Bissau	132	2.40	103	2.40	148	2.09	119	2.51	142	2.24	130	2.35	134	2.74
Fiji	133	2.39	124	2.29	116	2.28	135	2.39	148	2.22	138	2.32	131	2.78
Myanmar	134	2.38	130	2.25	124	2.22	154	2.25	138	2.27	113	2.47	121	2.84
Bolivia	135	2.38	139	2.16	136	2.17	131	2.42	146	2.23	114	2.47	129	2.79
Nepal	136	2.38	151	2.08	133	2.18	129	2.43	147	2.23	116	2.45	119	2.86
Liberia	137	2.36	133	2.21	128	2.21	139	2.37	129	2.34	143	2.27	138	2.73
Sudan	138	2.35	147	2.11	151	2.07	140	2.36	133	2.29	129	2.36	117	2.88
Burundi	139	2.34	148	2.10	155	2.03	149	2.30	137	2.27	119	2.43	114	2.91
Bhutan	140	2.34	134	2.18	153	2.05	122	2.48	124	2.36	141	2.29	150	2.63
Libya	141	2.33	153	2.07	150	2.08	136	2.39	120	2.40	149	2.20	127	2.81
Angola	142	2.33	157	2.02	140	2.14	123	2.47	141	2.25	139	2.31	136	2.73
Madagascar	143	2.32	118	2.32	130	2.20	147	2.32	153	2.18	147	2.22	143	2.68
Yemen, Rep.	144	2.30	165	1.77	156	2.01	127	2.45	134	2.29	128	2.36	116	2.89
Gambia, The	145	2.29	144	2.11	157	2.00	93	2.65	136	2.28	154	2.12	160	2.52
Turkmenistan	146	2.29	143	2.11	122	2.25	132	2.41	157	2.13	157	2.08	135	2.74
Cameroon	147	2.27	154	2.07	146	2.11	159	2.14	119	2.40	144	2.27	153	2.60
Chad	148	2.27	136	2.16	142	2.13	142	2.36	158	2.12	148	2.21	155	2.58
Congo, Rep.	149	2.26	164	1.84	139	2.15	151	2.26	144	2.23	126	2.37	140	2.72
Cuba	150	2.26	128	2.26	141	2.13	143	2.33	154	2.18	150	2.20	162	2.46
Zimbabwe	151	2.24	156	2.03	125	2.22	155	2.24	139	2.26	153	2.13	156	2.57
Congo, Dem. Rep.	152	2.24	142	2.11	159	1.97	158	2.17	149	2.22	140	2.30	147	2.64
Lao PDR	153	2.24	149	2.10	158	1.98	144	2.33	150	2.21	161	2.02	137	2.73
Tajikistan	154	2.24	145	2.11	135	2.17	145	2.33	143	2.23	152	2.18	164	2.36
Gabon	155	2.23	155	2.05	154	2.05	138	2.38	151	2.21	156	2.09	158	2.55
Kyrgyz Republic	156	2.23	159	1.99	152	2.06	153	2.25	159	2.07	137	2.32	146	2.65
Djibouti	157	2.21	131	2.23	145	2.12	156	2.21	161	2.02	160	2.04	148	2.64
Iraq	158	2.19	160	1.97	160	1.95	146	2.32	160	2.06	158	2.05	139	2.72
Lesotho	159	2.16	158	2.01	147	2.10	163	2.07	145	2.23	159	2.05	161	2.50
Afghanistan	160	2.15	146	2.11	163	1.86	152	2.26	156	2.14	165	1.88	154	2.60
Eritrea	161	2.11	161	1.91	162	1.88	162	2.12	152	2.19	162	1.96	159	2.55
Equatorial Guinea	162	2.10	150	2.10	164	1.79	165	1.99	162	1.96	151	2.19	157	2.57
Mauritania	163	2.07	140	2.12	161	1.93	161	2.12	163	1.93	166	1.87	163	2.40
Sierra Leone	164	2.04	163	1.85	129	2.21	160	2.13	164	1.88	164	1.90	166	2.28
Haiti	165	1.96	162	1.89	166	1.70	164	2.04	165	1.86	163	1.90	165	2.35
Syrian Arab Republic	166	1.94	166	1.61	165	1.72	166	1.84	166	1.73	155	2.12	152	2.62
Somalia	167	1.67	167	1.49	167	1.54	167	1.72	167	1.72	167	1.51	167	2.03

Source: Logistics Performance Index 2010, 2012, 2014, and 2016.

APPENDIX 5

The LPI methodology

Because logistics has many dimensions, measuring and summarizing performance across countries are challenging. Examining the time and costs associated with logistics processes—port processing, customs clearance, transport, and the like—is a good start, and, in many cases, this information is readily available. But even if complete, this information cannot be easily aggregated into a single, consistent, cross-country dataset because of structural differences in country supply chains. Even more important, many critical elements of good logistics such as process transparency and service quality, predictability, and reliability cannot be assessed using only time and cost information.

Constructing the international LPI

The first part of the LPI survey (questions 10–15) provides the raw data for the international LPI. Each survey respondent rates eight overseas markets on six core components of logistics performance. The eight markets are chosen at random based on the most important export and import markets of the country where the respondent is located. Among respondents in landlocked countries, the selection is based on neighboring transit countries that form part of the landbridge connecting the landlocked country with international markets. The method used to select the group of countries rated by each respondent varies by the characteristics of the country where the respondent is located (table A5.1).

Respondents take the survey online. In the 2016 edition, the survey was open in two phases, in October–December 2015 and in March–April 2016. The two-phased approach helped to build up the respondent base using a more targeted outreach effort in those regions where limited coverage was observed after the first phase concluded.

The web engine for 2016 is the same as the new engine put in place in 2012. It follows a uniform sampling randomized approach to gain the most possible responses from underrepresented countries. Because the survey engine relies heavily on a specialized country-selection methodology for survey respondents based on high trade volume between countries, the randomized approach can help countries with lower trade volumes rise to the top during country selection.

The 2015/16 survey engine builds a set of countries for the survey respondents that are subject to the rule set (see table A5.1). After 200 surveys, the uniform sampling randomized approach is introduced into the engine's process for country selection. For each new survey respondent, the method solicits a response from a country chosen at random but with nonuniform probability, and weights are chosen to evolve the sampling toward uniform probability. Specifically, a country i is chosen with a probability $(N - n_i) / 2N$, where n_i is the sample size of country i so far, and N is the total sample size.

The international LPI is a summary indicator of logistics sector performance, combining data on six core performance components into a single aggregate measure. Some respondents did not provide information for all six components, so interpolation is used to fill in missing values. The missing values are replaced with the country mean response for each question, adjusted by the respondent's average deviation from the country mean in the answered questions.

The six core components are:

- *The efficiency of customs and border management clearance*, rated from very low (1) to very high (5) in survey question 10.

Table A5.1 **Methodology for selecting country groups for survey respondents**

	Respondents from low-income countries	Respondents from middle-income countries	Respondents from high-income countries
Respondents from coastal countries	Five most important export partner countries + Three most important partner countries	Three most important export partner countries + The most important import partner country + Four countries randomly, one from each country group: a. Africa b. East, South, and Central Asia c. Latin America d. Europe less Central Asia and OECD	Two countries randomly from a list of five most important export partner countries and five most important import partner countries + Four countries randomly, one from each country group: a. Africa b. East, South, and Central Asia c. Latin America d. Europe less Central Asia and OECD + Two countries randomly from the combined country groups a, b, c, and d
Respondents from landlocked countries	Four most important export partner countries + Two most important import partner countries + Two land-bridge countries	Three most important export partner countries + The most important import partner country + Two land-bridge countries + Two countries randomly, one from each country group: a. Africa, East, South, and Central Asia, and Latin America b. Europe less Central Asia and OECD	

Source: Logistics Performance Index 2016.

- *The quality of trade and transport infrastructure*, rated from very low (1) to very high (5) in survey question 11.
- *The ease of arranging competitively priced shipments*, rated from very difficult (1) to very easy (5) in survey question 12.
- *The competence and quality of logistics services*, rated from very low (1) to very high (5) in survey question 13.
- *The ability to track and trace consignments*, rated from very low (1) to very high (5) in survey question 14.
- *The frequency with which shipments reach consignees within scheduled or expected delivery times*, rated from hardly ever (1) to nearly always (5) in survey question 15.

The LPI is constructed from these six indicators using principal component analysis, a standard statistical technique used to reduce the dimensionality of a dataset. In the LPI, the inputs for the analysis are country scores on questions 10–15, averaged across all respondents providing data on a given overseas market. Scores are normalized by subtracting the sample mean and dividing by the standard deviation before conducting the analysis. The output of the analysis is a single indicator, the LPI, which is a weighted average of the scores. The weights are chosen to maximize the percentage of variation in the original six LPI indicators that is accounted for by the summary indicator.

Full details on the principal component analysis procedure are shown in tables A5.2 and A5.3. The first line of table A5.2 shows that the first (principal) eigenvalue of the correlation matrix of the six core indicators is greater than 1 and much larger than any other eigenvalue. Standard statistical tests, such as the Kaiser Criterion and the eigenvalue scree plot, suggest that a single principal component should be retained to summarize the underlying data. This principal component is the international LPI. Table A5.2 shows that the international LPI accounts for 92 percent of the variation in the six components.

To construct the international LPI, normalized scores for each of the six original indicators are multiplied by their component loadings

(table A5.3) and then summed. The component loadings represent the weight given to each original indicator in constructing the international LPI. Since the loadings are similar for all six, the international LPI is close to a simple average of the indicators. Although principal component analysis is rerun for each version of the LPI, the weights remain steady from year to year. There is thus a high degree of comparability across the various LPI editions.

Constructing the confidence intervals

To account for the sampling error created by the LPI's survey-based methodology, LPI scores are presented with approximate 80 percent confidence intervals. These intervals make it possible to provide upper and lower bounds for a country's LPI score and rank. To determine whether a change in score or a difference between two scores is statistically significant, confidence intervals must be examined carefully. For example, a statistically significant improvement in a country's performance should not be inferred unless the lower bound of the country's 2016 LPI score exceeds the upper bound of its 2014 score.

To calculate the confidence interval, the standard error of LPI scores across all respondents is estimated for a country. The upper and lower bounds of the confidence interval are then

$$LPI \pm \frac{t_{(0.1, N-1)} S}{\sqrt{N}},$$

where LPI is a country's LPI score, N is the number of survey respondents for that country, s is the estimated standard error of each country's LPI score, and t is Student's t-distribution. As a result of this approach, confidence intervals and low-high ranges for scores and ranks are larger for small markets with few respondents because these estimates are less certain.

The high and low scores are used to calculate upper and lower bounds on country ranks. The upper bound is the LPI rank a country would receive if its LPI score were at the upper bound of the confidence interval rather than at the center. The lower bound is the LPI rank a country would receive if its LPI score were at the lower bound of the confidence interval rather than at the center. In both cases, the scores of all other countries are kept constant.

The average confidence interval on the 1–5 scale is 0.23, or about 8 percent of the average country's LPI score. Because of the bunching of LPI scores in the middle of the distribution, the confidence interval translates into an average of 20 rank places, using upper and lower rank bounds as calculated above. Caution is required in interpreting small differences in LPI scores and rankings.

Although it is the most comprehensive data source for country logistics and trade facilitation, the LPI has two important limitations. First, the experience of international freight forwarders might not represent the broader logistics environment in poor countries, which often rely on traditional operators. And international and traditional operators might differ in their interactions with government agencies and in their service levels. Second, for landlocked countries and small island states, the LPI might reflect access problems outside the

Table A5.2 Results of principal component analysis for the international LPI

			Variance proportion	
Component	Eigenvalue	Difference	Individual	Cumulative
1	5.66	5.55	0.94	0.94
2	0.11	0.03	0.02	0.96
3	0.08	0.02	0.01	0.98
4	0.06	0.02	0.01	0.99
5	0.05	0.01	0.01	0.99
6	0.04	na	0.01	1.00

na is not applicable.

Table A5.3 Component loadings for the international LPI

Component	Weight
Customs	0.41
Infrastructure	0.41
International shipments	0.41
Logistics quality and competence	0.41
Tracking and tracing	0.41
Timeliness	0.40

country assessed, such as transit difficulties. The low rating of a landlocked country might not adequately reflect the country's trade facilitation efforts, which depend on the workings of complex international transit systems. Landlocked countries cannot eliminate transit inefficiencies through domestic reforms.

Constructing the domestic LPI database

The second part of the LPI survey instrument is the domestic LPI, in which respondents provide qualitative and quantitative information on the logistics environment in the country where they work.

Questions 17–22 ask respondents to choose one of five performance categories. In question 17, for example, they can describe port charges in their country as very high, high, average, low, or very low. As in the international LPI, these options are coded from 1 (worst) to 5 (best). Appendix 2 displays country averages of the percentage of respondents rating each aspect of the logistics environment as 1–2 or 4–5. Question 23 refers to the availability of qualified staff for different groups of employees in logistics (operative, administrative, supervisory and managerial staff).

With a few exceptions, questions 24–35 ask respondents for quantitative information on their countries' international supply chains, offering choices in a dropdown menu. When a response indicates a single value, the answer is coded as the logarithm of that value. When a response indicates a range, the answer is coded as the logarithm of the midpoint of that range. For example, export distance can be indicated as less than 50 kilometers, 50–100 kilometers, 100–500 kilometers, and so forth; so, a response of 50–100 kilometers is coded as log(75). Full details of the coding matrix are available on request.

Country scores are produced by exponentiating the average of responses in logarithms across all respondents for a given country. This method is equivalent to taking a geometric average in levels. Scores for regions, income groups, and LPI quintiles are simple averages of the relevant country scores.

APPENDIX 6

Respondent demographics

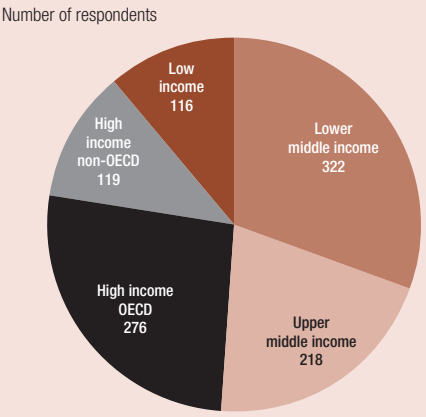
Operators on the ground are best placed to assess the vital aspects of logistics performance. The LPI thus uses a structured online survey of logistics professionals at multinational freight forwarders and at the main express carriers. The 2016 LPI data are based on a survey conducted between October and December 2015 and between March and April 2016 among 1,051 respondents at international logistics companies in 132 countries. The number of respondents is about the same in the 2016 LPI as in other editions of the LPI.

Geographic dispersion of respondents

The location of respondents for the 2016 LPI reflects the growing importance of trade facilitation for the developing world. Among the respondents, 62 percent are in either low-income countries (11 percent) or middle-income countries (51 percent). The overall number is similar to the 2014 LPI, but, this year, there are relatively more contributions from low-income countries. Their relative lack of representation, however, is due to their more marginal role in world trade and the difficulty of communicating effectively with operators on the ground (figure A6.1).

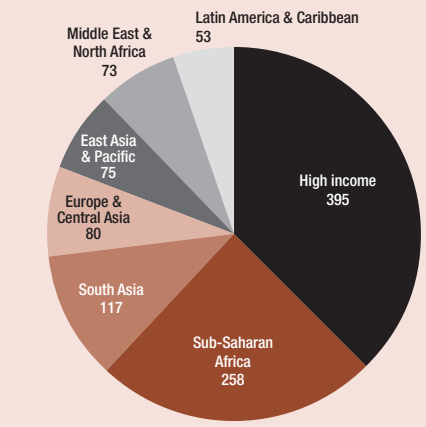
Among developing countries, all regions are well represented (figure A6.2). Compared with previous surveys, the 2016 edition does a better job of including Sub-Saharan Africa, thanks in part to the two-stage sampling methodology adopted on this occasion. It remains important to ensure that developing countries from all regions are adequately represented among respondents, although proportions across regions necessarily vary from year to year.

Figure A6.1 **2016 LPI survey respondents, by World Bank income group**



Source: Logistics Performance Index 2016.

Figure A6.2 **2016 LPI survey respondents, by World Bank region**



Note: World Bank regions do not include high-income countries, so they are included as a separate category.
Source: Logistics Performance Index 2016.

Respondents' positions in their companies

The LPI assesses large companies as well as small and medium enterprises. Large companies (those with 250 employees or more) account for around 24.5 percent of responses, which is slightly higher than in 2014. Most of the responses are thus from small and medium enterprises.

Knowledgeable senior company members are important to the survey. The 2016 respondents include senior executives (53 percent), area or country managers (15 percent), and department managers (16 percent). These groups of professionals have oversight responsibilities or are directly involved in day-to-day operations not only from company headquarters but also from country offices. The relative seniority of respondents has slightly increased from 2014 to 2016. Two-thirds of respondents are at corporate or regional headquarters (43 percent) or at country branch offices (22 percent). The rest are at local branch offices (6 percent) or independent firms (27 percent).

The majority of respondents (52 percent) are involved in providing a range of logistics services as their main line of work. Such services include warehousing and distribution, customer-tailored logistics solutions, courier services, bulk or break bulk cargo transport, and less than full container, full container, or full trailer load transport. By contrast, only 33 percent of respondents are at companies with business models based on full-container or full-trailer load transport (22 percent) or on customer-tailored logistics solutions (11 percent).

Among all respondents, 46 percent deal with multimodal transport, 24 percent with maritime transport, and 11 percent with air transport. Whereas 3 percent only handle domestic trade, 46 percent deal with exports or imports. And whereas 29 percent work with most of the world's regions, others concentrate their work in Europe (27 percent), Asia (18 percent), Africa (14 percent), or the Americas (8 percent). The remaining 4 percent are divided between the Middle East and Australia and the Pacific.

Bilateral perception issues

Bilateral issues might play a role in driving survey respondents' perceptions when rating their respective regions. In the last edition of the LPI, it was noted that, while idiosyncratic effects can shift the perception of certain regions about the logistics performance of more distant trading partners and regional neighbors, these effects did not represent a significant bias. Using the case of Latin America, it was found that, while these effects inevitably exist, despite subjectivity, the LPI scores were relatively tightly placed around the average, indicating a limited effect of any possible bias.

In the current edition of the LPI, the two data collection phases increased the exposure of the survey to geographies that have been traditionally less present among respondents. In particular, a higher share of respondents included logistics operators in Sub-Saharan Africa. Based on simple comparisons of reciprocal assessments across regions, Sub-Saharan respondents seemingly tend to be much more lenient with other Sub-Saharan countries than the rest of the respondents from other geographies. While we believe the effect is certainly not negligible, controlling for this effect in an ad hoc manner would require a substantial overhaul of the LPI methodology, possibly creating a discontinuity in the comparability across editions. In consequence, this possible leniency effect should be considered in evaluating the results of Sub-Saharan countries in the overall context of the survey. The issue of idiosyncratic bias in a perception-based survey merits further research to derive additional logistics performance metrics that are neutral to the mentioned effects.

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What is the Logistics Performance Index?

Based on a worldwide survey of global freight forwarders and express carriers, the Logistics Performance Index is a benchmarking tool developed by the World Bank that measures performance along the logistics supply chain within a country. Allowing for comparisons across 160 countries, the index can help countries identify challenges and opportunities and improve their logistics performance. The World Bank conducts the survey every two years.

Reliable logistics is indispensable to integrate global value chains—and reap the benefit of trade opportunities for growth and poverty reduction. The ability to connect to the global logistics web depends on a country's infrastructure, service markets, and trade processes. Government and the private sector in many developing countries should improve these areas—or face the large and growing costs of exclusion.

Logistics Performance Index

International Federation for Freight Forwarders Associations

GFP

Global Facilitation Partnership for Transportation and Trade

Turun yliopisto
University of Turku

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This is the fifth edition of *Connecting to Compete,* a report summarizing the findings from the new dataset for Logistics Performance Index (LPI) and its component indicators. The 2016 LPI also provides expanded data on supply chains performance and constraints in more than 125 countries, including information on time, cost, and reliability and ratings on domestic infrastructure quality, services, or border agencies. The 2016 LPI encapsulates the firsthand knowledge of movers of international trade. This information is relevant for policymakers and the private sector seeking to identify reform priorities for "soft" and "hard" trade and logistics infrastructure. Findings include:

- The "logistics gap" between more and less developed countries persists. The gap between the top ranked countries and those at the bottom of the scale widened in 2016.
- Supply chain reliability continues to be a major concern for traders and logistics providers alike.
- Infrastructure still plays an important role in assuring basic connectivity and access to gateways for most developing countries.
- Improvements in trade facilitation are critical for the countries performing lowest in terms of logistics, including many low- income economies.
- The logistics agenda is broadening: the 2016 edition includes findings regarding skills shortages and the growing demand for sustainable logistics solutions.