WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Global Agenda Council on Logistics & Supply Chain Systems 2012-2014

Outlook on the Logistics & Supply Chain Industry 2013

July 2013

Published by World Economic Forum,
Geneva, Switzerland, 2013

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org

Contents

Message from the World Economic Forum

Sean Doherty
Director, Head Logistics & Supply Chain Industries
World Economic Forum

Tiffany Misrahi
Knowledge Manager, Global Agenda Councils
World Economic Forum

The World Economic Forum's Global Agenda Councils are unique multistakeholder groups that convene leading experts from academia, international organizations, and the public and private sectors to provide input to global collaboration and decision-making processes.

The Council on Logistics & Supply Chain Systems brings together global strategic thinkers broadly representative of the logistics and supply chain sector. The Council explores opportunities for the sector relevant to the Forum's mission of improving the state of the world, and recommends topics and actions to the World Economic Forum's Supply Chain & Transport CEO community.

The following collection of short essays highlights some of the topics discussed by the Council over the past year, in the voices of individual Council Members.

Reflecting the conversations, the essays are clustered around the issues of trade facilitation, opportunities and threats, notably climate change adaptation, connectivity and the intelligent use of data. They also focus on specific applications, particularly agricultural supply chains and regional imperatives.

We would like to thank each of the Council Members for their contributions, dedication and wisdom. We would particularly like to thank the Council Chairman, Bernard Hoekman, and the Vice-Chairman, Alan McKinnon, for their leadership and commitment.

Global Agenda Council on Logistics & Supply Chain Systems, 2012-2014 Members

Vineet Agarwal

Joint Managing Director
Transport Corporation of India Ltd
India

Bernard Hoekman

Research Director, Global Economics
European University Institute
Italy

Hong Junjie

Dean, School of International Trade and Economics
University of International Business and Economics
People's Republic of China

Soren Karas

Vice-President and Head, Group Strategy
A.P. Møller-Maersk A/S
Denmark

Petra Kiwitt

Executive Vice-President, DHL Solutions and Innovations
Deutsche Post DHL
Germany

Ralph Körfgen

Head, Corporate Development
Deutsche Bahn AG
Germany

Rob Kusiciel

Vice-President, Inbound Transportation and Global Logistics
Wal-Mart Stores Inc.
USA

John Manners-Bell

Chief Executive Officer
Transport Intelligence Ltd
United Kingdom

Alan McKinnon

Professor and Head, Logistics
Kühne Logistics University
Germany

Anne Miroux

Director, Division on Technology and Logistics
United Nations Conference on Trade and Development (UNCTAD)
Geneva

Virginia Mnguni

Chief Risk Officer
Sasol Limited
South Africa

Tony Prophet

Senior Vice-President, Supply Chain Operations,
Personal Systems Group (PSG) Worldwide
Hewlett-Packard Company
USA

Hugh Donald Ratliff

Regents Professor and Executive Director,
Supply Chain and Logistics Institute
Georgia Institute of Technology
USA

Rodolfo Sabonge

Vice-President, Market Research & Analysis
Panama Canal Authority
Panama

Mohammed Sharaf

Chief Executive Officer
DP World
United Arab Emirates

Yossi Sheffi

Elisha Gray II Professor of Engineering Systems and Director,
Transportation and Logistics
Massachusetts Institute of Technology (MIT)
USA

Pier Luigi Sigismondi

Chief Supply Chain Officer
Unilever
United Kingdom

Jonathan Wright

Managing Director, APAC Management Consulting-Comms,
Media and Technology Sector
Accenture
Singapore

Zhu Gaozhang

Director, Enforcement and Facilitation
World Customs Organization (WCO)
Brussels

Introduction

The ratio of trade to GDP for the world as a whole – a commonly-used measure of the openness of economies – has increased from 39% in 1990 to 59% in 2011. The total value of global trade today exceeds US$ 20 trillion. The explosion in global trade that has occurred in the last two decades is in part a reflection of the innovations in logistics and changes in policies in countries around the world that have led to a reduction in the costs of shipping goods and services across borders.

International supply networks and value chains are an ever more prominent feature of global commerce, with goods being processed and value being added in multiple countries. Modern production often implies that goods cross many borders, undergoing processing and accruing components in diverse settings before ending up in a retail store. The driver of this "splintering" of the production process is the pursuit of efficiency: the total cost of production can be lowered by allocating different parts of the production process across different countries. Logistics is a critical service without which global supply chains would not be viable. The lower the costs and the greater the quality of services provided by logistics companies, the better off customers and consumers.

The Global Agenda Council on Logistics & Supply Chain Systems brings together practitioners and experts who work in the area of logistics broadly defined to span the operation of international supply networks. A distinguishing feature of the group is that the focus is on issues that are of concern to both users and suppliers of transport and third-party logistics (3PL) services. Users of these services include shippers and manufacturers spanning numerous industries, ranging from chemicals to electronics to food products. Suppliers include maritime shipping companies, the express industry and 3PL providers. The focus of the Council is on issues that affect the operation of global value networks and on the identification of initiatives that could be pursued to improve the operation of the global logistics industry.

The Council's deliberations and activities have centred on a number of areas, all of which influence the cost of transportation and thus the overall costs of goods and services. A central premise of the Council is that targeted efforts and concerted action by industry and governments to lower logistics costs are particularly important in the current economic context where the priority for policy-makers is to increase economic growth and create jobs. Improving the efficiency of logistics and the operation of supply chains and production networks has the potential to contribute significantly to achieving this objective. High logistics costs are akin to a tax on international trade and on the goods and services that are ultimately consumed by households. However, whereas a tax generates revenues for governments that can be used to provide public goods and services, a "logistics tax" resulting from inefficiencies in the supply chain that could be removed or ameliorated simply constitutes social waste.

A major report launched by the World Economic Forum at the Annual Meeting in Davos-Klosters in January 2013, *Enabling Trade: Valuing Growth Opportunities*, was a result of an initiative proposed by the Council. Produced in collaboration with Bain & Company and the World Bank, it concluded that a concerted effort to remove supply chain barriers could have a significant positive impact on global economic activity in the medium term. If all countries were to improve their logistics performance and reduce supply chain barriers to just half the level observed in the best-performing country in their respective regions, global GDP could increase by 2.6%.

Indeed, if countries were to be more ambitious and improve their border management and transport-related infrastructure services to attain 50% of the global best practice level (as observed in Singapore), global GDP would jump by 4.7% – six times more than what could result from removing all import tariffs. Such large increases in GDP would be associated with positive effects on unemployment, potentially adding millions of jobs to the global workforce, the report found.

In Part 1 of this Outlook, Council Members Bernard Hoekman, Zhu Gaozhang, Soren Karas and Rodolfo Sabonge discuss the findings of the report and some of its implications for – and potential impacts of – better customs management, greater investment in transport infrastructure and its improved management.

An important question is what needs to be done to capture such gains and what instruments exist that could be used by businesses and governments to pursue actions that will reduce supply chain barriers and related costs. The Council is of the view that much of what needs to be done in this regard must be pursued at the national level, but that international cooperation, and, more specifically, trade agreements, can be an important supporting mechanism to identify and implement reforms. Examples are the ongoing Trans-Pacific Partnership (TPP) discussions and the recently-launched Transatlantic Trade and Investment Partnership (TTIP) talks between the European Union and the United States. In general, a key recommendation that emerges from the Outlook and the activities of the Council is that governments should take more of a supply-chain approach to policy and foster greater coordination across their ministries of trade, transport and economics in order to reduce barriers along global supply chains.

In Part 2 of this Outlook, the focus is on five subjects that were the pivots of deliberations and discussion: the impacts of urbanization and the increasing number of "mega cities" around the world (Petra Kiwitt); the impacts of technological advances, specifically "additive manufacturing" (Yossi Sheffi); the rising threat of cyberattacks to logistics networks (John Manners-Bell); the opportunities of and challenges to harnessing of "big data" to improve supply chain efficiency (Hugh Donald Ratliff); and adapting to global climate change. Climate change is a major medium-term risk factor for the industry and for all other industries and consumers who now depend on efficient logistics for reliable access to goods, including products that are critical for livelihoods and health, such as pharmaceuticals and food products. As argued by Alan McKinnon in his contribution to this Outlook, there is an urgent need for increased awareness and action by governments and industry to build greater resilience to more frequent occurrences of climate-related adverse events. Sustainability needs to figure more prominently on the global policy agenda.

In Part 3, Council Members focus on how logistics can be a part of the solutions to global challenges and offer opportunities to improve global welfare. John Manners-Bell and Anne Miroux discuss how food security can be enhanced by reducing post-harvest food losses in both developed and developing countries through more efficient supply chains for food products. Post-harvest food losses are often very large – they can extend up to one-third of total harvests according to the United Nations' Food and Agriculture Organization (FAO). In his contribution, Tony Prophet discusses how supply-chain management and international cooperation are being used to achieve a conflict mineral-free supply chain. Vineet Agarwal focuses on the case of India and the huge potential for growth that is associated with improving logistics performance in that country. Finally, Jonathan Wright discusses the implications for supply chain management of the great heterogeneity across countries in the Asia-Pacific and the opportunities that exist within the industry to address the resulting constraints and complexities.

Key Council Insights and Recommendations

Logistics is a key part of the "plumbing" of the global trading system. The efficiency of logistics-related industries has a major influence on investment decisions of companies large and small, and thus affects the extent and location of job creation around the world. The key insight from the work of the Council during the last year is that logistics matters much more for the overall health and dynamism of the world economy than policy-makers appear to realize.

Economic stimulus

If serious efforts were made to facilitate trade – by removing policies that create supply chain barriers, delays and associated uncertainty – real incomes, investment and economic activity would experience a big positive effect. At a time of recession, austerity measures and fiscal constraints, a global trade facilitation initiative that substantially reduces supply chain barriers offers a low-cost source of economic stimulus. Lowering of trade costs by improving border management, bolstering transport infrastructure and removing competition-reducing policies in the areas of transport and communication services could have an impact many times more powerful than that of other possible initiatives for lowering the tax burden on trade.

A report prepared by the World Economic Forum, Bain & Company and the World Bank, *Enabling Trade: Valuing Growth Opportunities*, concludes that improving logistics is many times more effective for trade facilitation than the abolition of all remaining import tariffs would be. The latter, in any case, is a highly improbable scenario as the subject of import tariffs has been holding up the Doha Development Round of trade negotiations at the World Trade Organization (WTO) for years. Rather than persisting with trade agreements that revolve around deals to lower tariffs, governments should prioritize action that aims at lowering supply chain costs for operators. This will have much bigger positive effects for consumers and households.

With talks at the WTO deadlocked, countries are exploring the bilateral and regional options of negotiating agreements among a smaller number of nations. Though a global effort would generate larger benefits, the regional route has the advantage of offering an opportunity for smaller groups of countries to pursue new, innovative approaches to lowering trade costs.

Such approaches can be used to address many of the issues that are discussed in this Outlook. As mentioned before, trade facilitation efforts to reduce supply chain costs offer a low-cost stimulus option for governments, both because much of the required action does not involve major investment and because in an environment where interest rates remain low, governments and firms have a unique opportunity to invest in improving infrastructure. At the same time, "thinking supply chain" in the design of trade and investment agreements can also lay the groundwork to support actions that will help economies address some of the major threats and opportunities that are discussed in this Outlook, including adaptation to climate change.

"Thinking supply chain"

The most readily-available opportunity for such a new, comprehensive "supply chain approach" is to make this a core element of the Transatlantic Trade and Investment Partnership (TTIP) talks that have just been launched by the European Union and the United States. The major recommendation of the Council is that the business community use the TTIP as an opportunity to operationalize the approaches that are elucidated in the World Economic Forum report *Enabling Trade: Valuing Growth Opportunities*.[1]

"Thinking supply chain" does not come naturally to policy-makers and analysts who instead tend to focus on specific policy instruments and irritants. Operationalizing approaches that would have direct impacts on supply chain costs is a complex undertaking as it will inevitably involve both businesses and a plethora of regulatory agencies that impact overall trade costs. Given that the European Union and the United States are very similar in terms of per capita incomes and economic size, but differ in their approach towards regulation, the TTIP offers them both an opportunity to identify ways to address the cost-increasing impacts of these differences and an imperative to do so. If the European Union and the United States cannot make meaningful progress in lowering policy-induced supply chain costs, the TTIP will be a failure.

A priority focus should be on policies that matter from a supply-chain perspective. This spans a number of the policy areas that are on the table for negotiation, including border management (customs clearance-related policies or "trade facilitation"); technical barriers to trade (for example, product standards); and transport and distribution services. The bottom line is that to have the greatest impact, all of these policy areas need to be approached holistically. An approach that centres on all of the policies that have a major impact on the efficiency of value chains offers the opportunity of significantly enhancing the commercial relevance of any agreement. International trade negotiations tend to take a silo approach, with each policy area

being addressed separately in a piecemeal fashion. Thus, in the WTO's Doha Round, talks on Trade Facilitation are separate from negotiations on Services, and each service sector is considered separately. Key sectors pertaining to supply chains, such as air and maritime transport, are handled in other forums or are altogether missing. Efforts to reduce trade barriers must better reflect the reality, which is that processing and transport of goods are performed as an interdependent chain, and any broken link only introduces discontinuity.

An important question is whether an integrated, "whole of the supply chain" approach that includes services is best pursued through a cross-cutting/horizontal approach or if sectoral initiatives can improve results. Bottlenecks may be very value chain-specific – automotive chains are very different from textiles chains – and the political economy forces that drive policies are likely to differ with the level of logistics performance and the trade potential this implies in the short- to medium-term. While a differentiated approach will be needed to address the specific constraints most salient for a given sector, a common framework and principles that underpin a supply chain approach to international cooperation on trade would ensure that the focus is on what matters most for the operation of production networks, as opposed to restricting agreements to specific policy instruments that may not be very important in practice.

Improving the world's food security

"Thinking supply chain" is never more relevant than when addressing the issue of post-harvest food losses. In March 2012, the world's population reached 7 billion and by some estimates could reach 10.9 billion by 2050. To date, most emphasis has been placed on the development of agricultural technologies, such as genetically-modified (GM) crops, as a way of meeting future needs. However, this ignores the fact that up to 50% – and sometimes more – of food in the developing world never makes it to the end consumer. The Council has been at the forefront of initiatives to focus efforts by farmers, wholesalers, manufacturers and governments on this issue. It has been advocating investment in better infrastructure and has showcased innovative waste-reducing solutions. The Council has established a project to measure food losses and explore new ways of cutting waste.

Managing urbanization

A growing population does not just have implications for the world's food supply. By some estimates, 70% of people are likely to be living in urban agglomerations by 2050, many of which will be defined as "megacities". Current generations have the opportunity to influence the development of these cities, ensuring that logistics is "designed" into the way that people, goods, waste, energy and data move around the built environment. The World Economic Forum is engaged with many stakeholders – governmental, commercial and academic – to ensure that efficient city logistics is at the heart of sustainable development.

A source of good

A better understanding of the supply chain can also play a key role in the development of Corporate and Social Responsibility (CSR) strategies. By enhancing visibility of its supply chain, Hewlett-Packard has been able to eradicate the use of conflict minerals in its products. It has done this in a way which still enables minerals to be sourced from war-torn areas, such as the Democratic Republic of Congo, preventing a de-facto embargo that would have brought economic hardship upon the local population. The Council will continue to highlight the benefits of initiatives such as these, and promote efforts to develop ethical supply chains.

Building resilience to climate change

The Council is also shining the spotlight on the necessity for logistics to adapt to changing environmental conditions. The industry suffers from a certain amount of complacency, and action is required urgently if supply chains are to be climate-proofed. This includes assessing the tolerance of transport infrastructure to more extreme weather events, stress-testing the resilience of logistics systems and adapting supply chains to new patterns of demand brought about by changes in temperature, water availability and disease. This new field of "adaptive logistics" will prove an important development in the Council's work to promote the latest thinking and provide practical advice for the industry.

Logistics for the technology of the future

Part of the Council's remit is to monitor new, disruptive trends and innovations and to assess their potential impact on supply chains. One such development is additive manufacturing – a production technique which some think will spark a new industrial revolution. Using "3D printers," an increasingly complex and diverse range of products can be built up layer-on-layer using multiple materials with minimal waste. Depending on how the technology develops, the implications for supply chains could be immense. Rather than transporting finished goods around the world, production could occur close to end markets, reducing their dependence on low-cost labour. This will not imply the end of globalization, but certainly could have major implications for the pattern and composition of global trade. The Council will continue to assess the impact of this potentially transformative technology.

Technology has also, of course, been fundamental to facilitating the flow of goods on a worldwide basis. A successful supply chain is one that shares data between multiple parties – manufacturers, customs departments, logistics providers and retailers. However, this openness is often a double-edged sword – it leaves supply chain communities vulnerable to cyberattacks from criminals, terrorists, foreign governments and so-called "hactivists". While much attention has been paid to the protection of supply chains against physical attack (such as X-ray screening of goods), less has been dedicated to the development of cyber defences. As the management of logistics systems is highly data-intensive, the secure transmission of data is absolutely critical. The Council, in collaboration with the World Economic Forum's Risk Response Network, has helped to devise new models of risk mitigation in supply chains. It will continue to support efforts to make supply chains more robust and resilient and highlight new threats to logistical systems as they emerge.

Part 1: The Importance of Trade Facilitation

Global Supply Chains and Trade Agreements: Beyond Business as Usual

Bernard Hoekman
Research Director, Global Economics,
European University Institute, Italy

Over the last 30 years, governments have greatly reduced barriers to trade. Average tariff levels have fallen to within the 5-10 per cent range, and many products today enter markets free of import duties. Trade liberalization has been complemented by technological and managerial advances that have led to an ever-increasing share of world trade comprising intermediate inputs, reflecting the ability of firms to splinter the production process into ever finer parts and to locate different tasks in different countries so as to minimize total costs of production. International supply chains and production networks are the mechanisms through which this process of specialization is organized.

Although barriers to trade have fallen dramatically, the costs associated with international transactions remain much higher than those that arise within countries. Trade costs result from a variety of factors that drive a wedge between the domestic and international prices of a product. Some of these factors are difficult or impossible to change – geography, for example. Thus, a small island-state located in the middle of the Pacific Ocean or a land-locked country may always have higher trade costs than countries or regions that have access to nearby ports or are located close to large and dynamic economic agglomerations.

However, a large part of observed trade costs are created by policy, and are due to factors that could be addressed through appropriate policies. Unfortunately, governments continue to impose trade restrictions on some sectors. They also limit the ability of foreign firms to compete in their markets through barriers to foreign direct investment or by reserving sectors for national firms. Prohibiting foreign carriers from providing domestic transport services (cabotage) is a common example, as is public procurement, in which governments give preference to national firms for public purchase of goods or services.

Non-tariff barriers

While such explicitly discriminatory policies can result in significant barriers to competition, the policies that restrict (and raise the cost of) international flows of goods, services and knowledge are increasingly domestic and of a regulatory nature – the so-called non-tariff measures (NTMs). Examples are product regulation (purportedly to achieve health, safety or security objectives), licensing requirements, certification and conformity assessment procedures, data reporting standards, border management procedures, the quality of transport and communications infrastructure, and the degree of competition that prevails in services markets.

Frequently, one cause of excess costs is a multiplicity of regulatory norms and related enforcement requirements that are pursued independently by many different government agencies. Many of these regulations often apply equally to local and foreign firms and products, but they generally increase trade costs more for foreign than domestic suppliers. This is simply because regulations differ across countries or because foreign firms are subject to a multiplicity of requirements that are redundant, and, in some cases, duplicative. More important, however, is the fact that regulatory policies can raise costs across the board – for domestic and foreign firms – and thus the price of goods and services for buyers, whether firms or households. Given that the value added that is embedded in goods is increasingly generated by services and knowledge, assessments of the trade costs that are created by regulatory measures need to include a strong focus on services.

A recent report by the World Economic Forum, in collaboration with Bain & Company and the World Bank, *Enabling Trade: Valuing Growth Opportunities*, analyses the incidence of some of the major non-tariff measures that affect the operation of international supply chains. The focus of the analysis is on the impact of two types of factors that can increase operating costs for international firms: border management (customs clearance and other regulatory requirements and processes that pertain to goods entering or leaving a country) and transport and communications infrastructure services. The report concludes that concerted action to raise the average performance of countries to half the level of best practice (as defined by Singapore) could increase global GDP by almost 5%, six times more than would result from removing all remaining import tariffs.

Why is lowering barriers so much more effective? The reason is that it eliminates resource waste, whereas abolishing tariffs mainly reallocates resources. Reducing supply chain barriers lowers costs and prices, both to consumers and to firms that import production inputs. Consumers gain access to a wider variety of goods. Workers benefit as well, as the boost to GDP is likely to stimulate employment growth. In the long run, trade facilitation promotes a shift in resources to more productive industries and firms, thereby increasing productivity and wages. Of course, reducing supply chain barriers requires investment, while tariff reductions require only the stroke of a pen. However, many barriers can be traced to regulation. Detailed analysis can enable policy-makers to prioritize the investments that are most critical and cost-efficient.

How to lower supply chain barriers

Given the significance of supply chain barriers for GDP growth, the international community should focus more on actively managing the effects of policies on trade costs. The World Economic Forum report makes several general policy recommendations for governments seeking to bring down supply chain barriers:

- Create a national mechanism to set policy priorities for improving supply chain efficiency based on objective performance data and feedback loops between government and firms. Governments must work with businesses and analysts to create mechanisms to collect data on the various factors affecting supply chain operations. These data can then be used to identify "clusters" of policies that jointly determine key supply chain barriers in order to set priorities for action. They can also be critical inputs into any assessment of progress made in addressing the barriers.
- Establish a focal point within government with a mandate to coordinate and oversee all regulation that directly affects the efficiency of the supply chain. Reducing the cost-raising effects of policies and improving supply-chain performance requires coherence and coordination across many government agencies and collaboration with industry.
- Ensure that SME interests are represented in the policy prioritization process and that solutions are designed to address specific constraints that disproportionately impact SMEs. For example, one relatively straightforward policy would be to raise de minimis provisions to facilitate small-business engagement in international markets; another is to ensure that initiatives to reduce regulatory compliance costs such as "trusted trader" programmes are open to smaller firms and are complemented by programmes to help them address regulatory complexity and lower their costs.

The impacts of NTMs on trade are certainly recognized by governments. One reflection of this is that trade agreements often deal with specific policies such as product regulation and customs valuation, and increasingly include a focus on "trade facilitation." Trade facilitation means different things in different contexts. At the World Trade Organization (WTO), it refers to border clearance processes and transit regimes. At the Asia-Pacific Economic Cooperation (APEC), a much broader approach is taken, with trade facilitation referring to any measure by government that aims to reduce trade costs. This is superior to the narrow approach taken by the WTO, as it offers a chance to address important policy areas, including those affecting the operation of services markets. The challenge is to identify the policy actions that have the greatest impact on trade costs and to develop a credible action plan to address them.

The current approaches pursued by governments are arguably not optimal because they focus on specific policy instruments individually. However, what is really needed is concerted action on a number of policy fronts. One way of determining priority areas for action is to analyse how policies impact the efficiency of international supply chains – an ever more prominent feature of global commerce, with goods being processed and value being added in multiple countries along a given value chain. Looking at the world through a supply-chain lens can help identify both where value is added and how policies affect costs and determine the location of value addition. Supply-chain barriers can arise from any policy that obstructs the easy movement of goods from one stage or link in a supply chain to the next. Border delays, inconsistent and redundant regulation, poor transport and communications infrastructure, inefficient or low-quality services, restrictive local-content policies, corruption and theft can all impact supply-chain costs.

A holistic approach

"Thinking supply chain" could help design trade agreements that are more relevant for businesses while increasing incentives for investment and job creation in trade-related activities. Explicit focus must be brought to bear on how the various policy areas being negotiated in trade agreements – tariffs, border management (e.g. customs clearance-related reforms such as the implementation of national single windows), technical barriers to trade (e.g. mutual recognition agreements) and transport and distribution (logistics) services – *jointly* affect supply chains.

However, international trade negotiations generally address each policy area separately in a piecemeal fashion. Thus, in the WTO's Doha Round, talks on Trade Facilitation are separate from negotiations on Services and each Service sector is considered separately. In the APEC context, a different approach has been taken with governments agreeing to a common target in two consecutive trade facilitation action plans – a total 10% reduction in trade costs – while leaving it to each government to decide how to achieve this goal. In this regard, the APEC approach is again superior to the approach of the WTO and the plethora of Preferential Trade Agreements (PTAs) extant in setting specific performance indicators. However, little guidance is given to governments on what actions will lower trade costs the most, while the non-binding nature of the APEC approach may lead to governments missing opportunities to cooperate in areas where concerted action could play a big role in lowering supply-chain barriers and costs.

A supply chain approach would not be very product-, sector- or policy instrument-specific. It would, however, address policies of the different domestic agencies responsible for NTMs, services regulation, etc. which together constitute major barriers to developing effective supply chains. Such an approach would encompass processes to identify priorities for action across the various regulatory "silos," establish baselines and set up effective monitoring mechanisms to track progress and hold governments accountable for meeting targets. As argued in the World Economic Forum report, this must involve the business community at all stages as firms are the primary source of the information needed to set priorities and monitor outcomes. Governments and stakeholders must answer a pressing question in the context of PTAs such as the Association of Southeast Asian Nations (ASEAN), the Trans-Pacific Partnership (TPP), or the recently-launched Transatlantic Trade and Investment Partnership (TTIP): to what extent are such PTAs fit for this purpose, and how can they be adapted to play such a role?

A key need arguably is to put in place processes that can cut across government and regulatory agencies. There is a need to go beyond technical regulatory impact assessments, NTM committees and working groups. A supply-chain perspective will facilitate a focus on how different types and combinations of regulation/policies affect key dimensions of supply chains and reduce efficiency or raise costs. While it is important to analyse the effect of specific measures, a more cross-cutting approach along the lines suggested in the Forum report will be more relevant to business.

Businesses need to take part in the process in a way that goes beyond "consultations" and "dialogue". At the front end, they must help identify what the most binding policy constraints are. At the back end, they must take an active part in the monitoring of progress by providing data to governments and holding them accountable for results.

Logistics from a Customs Perspective

Zhu Gaozhang
Director, Enforcement and Facilitation,
World Customs Organization, Brussels

For the first time in its history, the World Economic Forum's *Global Enabling Trade Report 2012* included questions on the "most problematic factors for exporting and importing" in its Executive Opinion Survey. The results showed that "tariffs and non-tariff barriers," as well as "burdensome import procedures" ranked 1 and 2, respectively, on the list of factors identified by respondents as the most problematic for imports. The report stated: "This result underlines not only the importance of trade facilitation at multilateral and bilateral levels, but also the potential of countries for facilitating trade through practical measures within their government's purview."[2]

This finding resonates with the World Customs Organization (WCO), which represents 179 customs administrations across the globe that collectively process approximately 98% of world trade.

Over the course of its relatively short history, the WCO has seen the role of customs evolve from one focused on revenue collection to an increasingly complex and multifaceted one arising from the globalization of trade. On the one hand, the need for effective security and control of international supply chains is growing while, on the other, the demands for greater facilitation of legitimate trade have been increasing.

Inherent in the idea of trade facilitation is the knowledge that economic well-being and wealth creation are driven by trade, and customs administrations play a vital role in ensuring the efficiency of international trade because they process cross-border consignments to ensure compliance with national regulatory requirements and international multilateral trading rules.

Facilitation in practice

To achieve the simplification and harmonization of customs procedures, the WCO has already developed a range of instruments outlined in the Kyoto Convention (the International Convention on The Simplification and Harmonization of Customs Procedures, which was signed in 1973 and revised extensively thereafter to meet the changing trade landscape). The Revised Kyoto Convention (RKC) came into force on 3 February 2006 and currently has 76 Contracting Parties. This Convention offers guidance on revenue collection and border control, while yielding facilitation dividends.

The RKC established a blueprint for modern customs procedures that is compatible with, and complementary to, World Trade Organization (WTO) agreements. WTO rules set out high principles such as predictability, transparency, partnership and the use of modern techniques including risk management. WCO instruments provide an administrative basis and practical guidance to ensure the effective implementation of these principles.

The WCO also recognizes that while customs is an essential part of the international trade supply chain, other border agencies should also be involved in the trade facilitation agenda to promote genuine cooperation and a more coordinated approach to border management.

WCO instruments and tools

The WCO had developed a series of tools and instruments to support national customs authorities in their efforts to improve procedures, enhance security and facilitate trade. These include:

- The single-window compendium that brings together the governance, legal, technical and administrative aspects of processing an international consignment into a single document. This supports national administrations in their implementation of a single-window system for border procedures in their countries.
- The WCO data model to support data harmonization and standardization among national customs administrations and other border agencies, and to facilitate inter-agency and cross-border interoperability among like-minded members.
- The risk management compendium that provides a common reference document for the concepts, terminology, approaches, methodologies and implementation techniques associated with risk management in customs agencies. This allows national authorities to perform risk-based assessment of traded products to facilitate the clearance of low-risk cargo.
- The SAFE framework of standards for supply-chain security, to assist WCO members in introducing robust Authorized Economic Operator (AEO) programmes.
- The time-release study methodology to identify problems and bottlenecks in the cross-border movement of goods so that effective solutions can be developed.

Taken together, these tools and instruments provide essential support to WCO members, helping them to adapt best practices and advanced border management methodologies to their national contexts while expanding their capacity and capability.

The positive contributions of customs to trade facilitation are illustrated in the World Bank's Logistics Performance Index (LPI) 2012, which noted that, "Across income groups, customs agencies have higher LPI ratings than all other agencies involved in border management. But in many countries, the agencies responsible for enforcing sanitary and phytosanitary regulations – and to less extent other product standards – lag well behind customs in their perceived performance. A comprehensive approach is needed to reform border management, with attention to all the relevant sectors and agencies."

Traders are indifferent to the distinction between customs and other agencies at the border, and rightly so: the trade does not care which government agency is delaying its goods, only that delays can cost them dear.

Coordinated border management and globally-networked customs

It is in view of this performance gap between customs and other border agencies that the WCO's Coordinated Border Management (CBM) and Globally Networked Customs (GNC) concepts have been developed. They help to ensure that trade facilitation is undertaken in a holistic manner, both within a country and across borders, so that legitimate trade flow is as seamless as possible.

To the WCO, better coordinated border management entails coordination and cooperation among all relevant authorities and agencies on regulations applying to the international movement of passengers, goods and conveyances across borders. Globally-networked customs fosters international cooperation in the development of communication standards and protocols between like-minded countries.

Conclusion

Facilitation and compliance are effectively two sides of the same coin – effective facilitation can only come about as a result of a trusted relationship between traders and government agencies at the borders. Traders must provide accurate information in a timely manner on the goods imported and exported, and comply with controls necessary to safeguard the public from potentially harmful products. Border agencies need to take a comprehensive approach towards border management to reduce duplication and delays. They must also ensure that procedures are up-to-date and effective in facilitating the flow of low-risk cargoes while focusing attention on high-risk ones.

Improving Transport Infrastructure: Spotting and Unlocking Countries' Trade Growth Potential

Soren Karas
Vice-President and Head, Group Strategy,
A.P. Møller-Maersk, Denmark

Louise Kjaergaard
Lead, Group Sustainability Communication,
A.P. Møller-Maersk, Denmark

The Global Enabling Trade Report of the World Economic Forum emphasises that there is immense potential for increasing global trade, and thereby economic growth, by reducing supply-chain barriers.[3] The global transport and logistics sector will play a key role in releasing this potential.

Rather than waiting for global growth to pick up, the global transport industry has already been forced to act, typically by enhancing efficiency, reducing costs wherever possible and investing in emerging markets. This can enable more efficient global trade of goods and stimulate economic development.

But what else can be done? Can global trade be further stimulated by better logistics solutions? Fostering partnerships with countries is one way to achieve this.

The case of Brazil

Today, most countries recognize the benefits of participating in global trade, but many do not fully exploit the business development opportunities available. Significant transport bottlenecks also remain. Brazil is one of the most vocal countries about the need to overcome logistics bottlenecks to realize its export ambitions and drive continued social progress. To that end, the government is stepping up its investments in infrastructure and is inviting private capital.

One of the key challenges in Brazil is the relatively high cost of logistics – corresponding to some 15-18% of the GDP (2011). Reducing these logistics costs would help boost trade and support Brazil's national competitiveness.

More trade with new ports and vessels

Not long ago, Maersk Line introduced a new type of container vessel to the South American market, the so-called SAMMAX (South America Maximum) vessels. These ships carry 72% more containers per vessel compared to Maersk Line's previous vessels on that trade lane. In spite of their larger size and capacity, the ships have been constructed to pass through shallow waters which historically have limited the benefits of larger ships in Brazil. The ships have a positive influence on the ports at which they call. For example, in Brazil's biggest port, Port of Santos, their average berth productivity is now 37% higher than with the previous Maersk vessels. This accelerates port turnaround and reduces the overall waiting time for everybody. That has a "trickle-up" effect offering a trade growth potential for the markets the ships connect. In Santos alone, this trade growth potential is estimated to be worth up to US$ 1.4 billion per annum without any upgrades to the port.

However, in Brazil, port capacity and productivity have long been under pressure. APM Terminals and Terminal Investment Ltd's US$ 1 billion investment in a new terminal in Santos, Brasil Terminal Portuario, will free up enough capacity to increase the annual container throughput at the port of Santos by up to 12%. When the Santos terminal opens for business at the end of 2013, it will generate some US$ 100 million in annual tax income, create 14,000 jobs, and offer a trade growth potential of up to US$ 15.3 billion every year.

How Brazil can reap the full benefits of private investment in transport infrastructure

Creating an environment that encourages investment in transport infrastructure can yield substantial benefits that go well beyond the individual operation. But most countries also have other levers to help promote trade efficiency and growth potential that go beyond investment in new terminals and larger ships. Certainly, Brazil has different options available, one of which is to alter its current freight modal split.

In Brazil today, trucks have a 58% share of the freight market (all cargo, total tons per kilometre) and ships only 13%. The extensive use of trucks makes roads the main bottleneck in the logistics chain, creating congestion, extending transport times and creating unreliability in delivery. Investing in road infrastructure would naturally reduce congestion and speed things up. But it is also Brazil's modal split that holds the key.

Brazil has significant social, environmental and economic reasons for "going coastal." Today, coastal shipping only transports cargo volumes corresponding to 4% of that moved by road transport. Switching freight to coastal shipping would cut road accidents, road maintenance, medical and material costs as well as exhaust emissions.

Maersk estimates that about 2.7 million containers (TEU) can be moved from trucks to coastal ships. This may not sound like a lot but corresponds to an 800% growth of the coastal shipping industry. This change in modal split would reduce, annually, road accidents by approximately 36,000, road accident costs by up to US$ 1.7 billion, road maintenance costs by US$ 125 million, and CO2 emissions by 4.4 million tons.

These "indirect," external costs may at times not receive the desired attention, but if they do, the case for countries expanding coastal shipping appears convincing. In the Enabling Trade report, reference is made to cabotage regulations which restrict coastal trade to domestic shipping lines. Such regulations are also currently in force in Brazil. As also illustrated in the Enabling Trade Report's case studies of China and the United States, relaxing maritime cabotage rules can cut costs. Perhaps equally importantly, it can also address a range of social and environmental issues.

The role of the shipping industry

In the global transport industry, Maersk is fortunate that its business and investment decisions are integral to the growth of international trade and the process of economic development. It plays an enabling role in society – enabling people to trade by creating access to markets and helping countries overcome domestic barriers to trade growth.

This goes beyond building efficient ports and ships. Indeed, identifying and unlocking new opportunities for trade growth and long-term economic development enables Maersk to play a role as trusted partners to countries and governments. That kind of partnership role involves more than simply quantifying trade growth potentials and socio-economic impacts of new business. It requires active stakeholder involvement and an open dialogue with decision-makers on ways of overcoming barriers and exploiting new opportunities for trade and development, at both national and international levels.

It goes without saying that the logistics sector shares a common interest with society in advancing trade and accelerating the many benefits of trade growth such as job creation, increased opportunities for business growth through market connectivity and wealth creation for billions of consumers worldwide.

At the end of the day, trade growth and economic development are mutually reinforcing. What comes first may not be very interesting. But the pace of their combined growth is of great interest to everyone in the logistics industry.

The Panama Canal and Its Impact on Latin America's Supply Chains and Logistics Operations

Rodolfo Sabonge
Vice-President, Market Research & Analysis,
Panama Canal Authority, Panama

The emerging markets, including Latin America, are poised to usher in the next stage of economic expansion. Barely touched by the international financial crisis, and buoyed by a relatively strong fiscal position, emerging economies have been the world's economic drivers for the last several years. Despite these countries' vulnerability to global demand, their expanding population along with rising incomes and a strengthening middle class are attracting foreign investment and prompting companies to re-evaluate their previous offshore sourcing and trade models.

Trade has been central to Latin America's growth, initially in terms of export of primary commodities and, more recently, in terms of manufacturing. The region's wealth of natural resources, including metals and commodities like coffee and soy, has placed such products at the core of the region's export platform. More recently, however, an evolving industrial base and regional proximity to the United States are encouraging manufacturers to invest in production facilities from which to supply the current and future centres of economic growth.

Fast growth in Mesoamerica

According to the Boston Consulting Group, cities in emerging markets accounted for more than 60% of world GDP in 2010 and this number will rise to 67% by 2015. Latin America's population is expected to rise by almost 20% between 2011 and 2030, expanding from 592 million to 704 million, creating a major source of consumption demand and significant opportunities for greater trade in goods and services. Looking only at Central America, the United States Census Bureau expects the population to expand by 25% between 2010 and 2030, while that of Mexico and Colombia is expected to grow by 19% and 22%, respectively.

The Mesoamerican sub-region, understood as a common economic space, spans the area between Colombia and Mexico, covering more than 3.6 million square kilometres and is home to over 200 million people. It lies on a relatively narrow strip of land between the Atlantic and Pacific oceans, making it a global east-west link as well as a north-south trade corridor for people and goods within the Americas. At its narrowest junction – connecting different regions and continents – lies the 80-kilometre Panama Canal.

Logistics facilitation and growth

Logistics facilitation will play a significant role in supporting higher rates of economic growth worldwide. A substantial portion of business costs in developing countries can be traced to inefficiencies in their supply chains, limitations created by physical bottlenecks and the lack of streamlined administrative procedures. A recent study with respect to the adoption of advanced supply chain solutions in Latin America highlights that retailers in the region seem to hold inventories twice as long as their US counterparts and that the figures are similar for manufacturing companies. These longer inventory periods translate into costs and lower competitiveness. As a result, the region's supply chain and logistics operations will need to be improved to make them more competitive and to take advantage of potential trade opportunities.

According to the World Bank, logistics-related expenses comprise between 15% and 30% of GDP and between 20% and 60% of the final price of food products in the region. The Inter-American Development Bank (IDB) estimates that transport costs account for up to two-thirds of the total costs of logistics operations, which in turn constitute approximately 15% of the final value of goods. This helps explain why transportation expenditures are the single largest item of public investment programmes, in some cases greater than 50%.

International trade flows, particularly exports, are crucial for countries' growth and development because they increase competition, expand government revenues and are a source of foreign exchange. These benefits are in part derived from the logistics sector, which can generate savings for consumers through price reductions brought about by a more efficient handling of goods. The benefits of supply chain improvements include:

- Increased export competitiveness and lower productions costs
- Lower cost of basic consumer products for poor households, who spend up to 80% of their income on food
- Greater integration of the economies in the region
- More environmentally-sustainable supply chains
- Increased security and less corruption associated with the movement of goods

Varied approaches

Throughout Latin America, governments and civil society have pursued the development of logistics, with specific approaches reflecting national challenges and limitations. In Central American countries such as Honduras, for instance, the focus is on developing road infrastructure and north-south connectivity. Guatemala is pursuing a grand plan for a "Technological Corridor" that includes 372 kilometres of a 140 metre-wide highway system, a transnational railway for container transport, upgrades of container port terminals on both its coasts, and construction of hydrocarbon storage facilities. Costa Rica, whose capital city lies in an agriculturally-rich highland valley in the middle of the country which is also witnessing expanding light manufacturing activity, is investing in road development to facilitate exports.

Larger countries such as Mexico, Colombia and Brazil are all aware of the new opportunities and are taking measures to address their particular challenges. Mexico, which has seen a recovery in investment in manufacturing for export to the United States (benefiting from China's increasing labour costs), is focusing on expansion of its ports and on its rail freight industry. Colombia, an agricultural powerhouse and oil and natural gas exporter, with decades of experience in light manufacturing and a much-improved security situation over the last decade, is expanding its logistical capabilities on both coasts, investing in its duty-free areas and dredging its ports. Similarly, Brazil has been investing heavily in port infrastructure to address rising demand for manufactured products and commodities.

The Panama Canal

One pivotal facilitator of regional trade is the Panama Canal, a key linkage for regional supply chains that convey products to markets. Since its opening in 1914, over 1 million vessels have transited the waterway, totalling over 9 billion long tons. The canal's main advantage is the great distance savings it provides. For example, the Guayaquil-New York journey through the canal is a mere 2,848 kilometres, whereas sailing around Cape Horn would extend it to 10,388 kilometres. Similar distance savings are observed for other routes, both within the American continent and for longer journeys such as from East Asia to the East Coast of the United States (US).

In 2012, approximately 218 million long tons transited through the canal, 84 million of which corresponded to the US East Coast-East Asia route. But the greater Mesoamerican region is also an important canal user: more than 41 million long tons crossed the canal from the West Coast of South America to Europe or the US, while total cargo from the West Coast of Central America to East Coast US reached 12.2 million long tons. Meanwhile, the Canal handled 3% of Central American international maritime trade, close to 11.1% for Colombia, 8.5% for the Caribbean and 6.6% for Mexico.

The canal expansion currently under way constitutes a paradigm shift for world maritime trade, particularly for users within the Americas. It will create greater economies of scale in sea transport, allowing 12,600 20-foot equivalent unit (TEU) ships of up to 49 metres in beam and 15.2 metres in draft to use the new locks. At present, the canal can accommodate container vessels of up to 4,400 TEUs.

The expansion project will be a boon for other sectors indirectly linked to canal traffic, further benefiting from the many competitive advantages Panama has to offer, including its dollarized economy, fiscal incentives and favorable legal framework for services industries including merchant marine registry, an international banking centre and legal services. The canal, the port terminals, the Colón Free Zone and Tocumen International Airport all complement each other's strengths. The expansion will allow more efficient supply chains and logistics operations, connecting countries and trading centres at a lower "per-unit" transportation cost. In short, the canal is the main driver within Panama's logistics cluster, and in turn the cluster strengthens the canal's position as an optimal transit option. This cross-sector synergy has a multiplier effect and increases the country's overall competitiveness, as well as that of other countries in the region which can use Panama as a hub.

Panama is turning into the main transport hub for the region's markets. It is broadening a trade corridor that connects existing and future consumption centres. The canal, together with a modern and efficient ports system, makes the country the ideal place for cargo consolidation and distribution for these markets: in 2010 trade between the Mesoamerican countries totalled 444,000 TEUs, which by 2030 will exceed 1 million TEUs (study conducted by INECON for *Dirección Ejecutiva del Proyecto Mesoamérica*[4]).

In sum, the canal is a crossroads for economic activities based on maritime traffic. It enhances the region's export potential by spurring export-dependent economic sectors. This potential is especially important in light of recent trade agreements signed with the United States and the European Union.

The canal expansion also complements and indirectly encourages logistics development in the rest of Latin America. By increasing their export potential, these countries will be investing more resources in public infrastructure and port terminals. The canal, the international logistics hub and the related services provided by Panama are not only the bedrock of the economy but also provide a support base for the entire region. As each country increases its logistical capabilities, the region as a whole will improve its competitiveness.


13
2
14

Part 2: Trends, Threats and New Technologies

Urbanization and City Logistics: Common Solutions, Uniquely Applied

Petra Kiwitt
Executive Vice-President, DHL Solutions and Innovations,
Deutsche Post DHL, Germany

Martin Brown
Programme Director, City Logistics,
Deutsche Post DHL, Germany

Urbanization will be a tour de force that will define the next century geographically, politically and economically. But will this trend occur uniformly across the globe? What new models will be required to manage logistics operations in expanding cities?

Today's cities offer employment, education and healthcare to many of their citizens. The megacities of tomorrow promise unprecedented lifestyle opportunities for those who can gain access to them.

It is widely estimated that by 2050 the world's population will reach 9 billion, with 70% of people living in urban agglomerations. Such urbanization will undoubtedly trigger an increased demand for accommodation, healthcare, space for recreation and, of course, for consumer goods and services – and therein lies one of many challenges.

Challenges, similar and unique

Megacities face many similar challenges. However, geographical and cultural differences give rise to specific issues which need to be addressed locally. What becomes increasingly apparent is that there is no "one-size-fits-all" approach that adequately tackles all the likely challenges. So what are likely to be the requirements of these cities of unparalleled size?

For all cities, the need to provide the basic elements of security, sustenance and shelter for their residents, irrespective of the political system, is universal. But urban areas are not growing at uniform rates or in the same way. In the digital age, with the distribution of Information and Technology Services, some cities in emerging regions like Africa (such as Addis Ababa or Nairobi) are leapfrogging the classic developmental path that western cities followed during their maturation, and at a rate few could have anticipated.

All cities are concerned with flows: of people, vehicles, goods and services, waste, energy and even data – all necessary to enhance cities' liveability and economic growth. Larger cities are becoming increasingly complicated ecosystems. The movement of both people and services within them is emerging as one of the most difficult challenges of our time. While urban congestion was merely an inconvenience some 20 or 30 years ago, it is now a source of competitive disadvantage for a city and its businesses. The negative repercussions of traffic gridlock affect almost every aspect of a city's performance.

Varied responses

Traditionally, the answer to this challenge has been investment in fixed assets: such as roads, railways and ports. Such an approach has its limitations: while the cost of capital has not been so low in over 30 years, large, capital-intensive infrastructure projects will not by themselves ease congestion and facilitate efficient flows, particularly on the so-called "last-mile" to the home, shop and office. And, of course, finding space to accommodate new infrastructure within a dense urban environment is in itself challenging.

Scarcity of space has helped to drive one major trend, particularly in Asian cities – the "verticalization" of central business districts and city centres. For city planners and logistics service providers alike, this means solutions have to anticipate deliveries to a variety of operations and stakeholders stacked in vertical columns. And these vast towers themselves need maintaining.

Away from the downtown area, the landscape differs greatly as skyscrapers give way to urban sprawl incorporating residential areas, and, in some cities, the quasi-official districts such as the favelas of Rio de Janeiro and Sao Paulo. In different parts of the world, these residential areas look, feel and operate in differing ways, each posing different types of retail logistics challenges.

A defining characteristic of commerce in the 21st century may be that of megacities competing against each other for the import of natural resources, the export of finished goods, the attraction and retention of a talented and skilled workforce, and for much-needed investment, both from the local government and foreign investors.

Many megacities aim to become more sustainable, but this term lends itself to multiple interpretations. Does this mean being more ecologically and environmentally friendly by, say, creating fewer environmental externalities and operating with a lower carbon footprint? Or does it mean drawing upon just enough natural resources to allow for sustained growth? Is long-term economic prosperity compatible with ecological responsibility within large cities?

Building risk resilience

Regardless of location, megacities increasingly need to be able to respond to a variety of tumultuous events, be they environmental (Tokyo's 2011 earthquake) or sociological (the London riots of 2011). The imperative to build resilience is forcing city officials to prepare for unplanned shocks to their systems and daily life. They hope to maintain continuity in the supply of goods and services, often by conducting risk assessment and contingency planning similar to that found in many multinational corporations, who have made these key elements of their supply chain management.

While megacities increasingly have mature strategies for personal and public transportation, freight is sometimes an afterthought. Well-run freight services significantly facilitate commerce – they can ease congestion and pollution problems. The integration of freight into a city's wider transportation and infrastructure system often follows no prescribed master plan and is done on an ad-hoc basis. Standard policy tools such as congestion charges in London or number-plate quotas in Mexico City and Singapore can have unintended consequences.

So megacities need to plan across a spectrum of policies, ranging from tactical measures – such as ensuring that streets have sufficient parking bays for delivery vehicles – to strategic infrastructural investment. State-subsidized logistics clusters are now commonplace, enabling economies of scope to be realized through shared vehicles, IT platforms, manual equipment handling facilities, labour availability and even shared marketing. Some of the principles formerly applied to urban logistics are now being revisited and challenged. Asset flexibility is the new buzzword, with the use of non-permanent assets for logistics activities, including redundant municipal spaces and even former church car parks in some European cities, all of which is now enabled through more widespread technology integration.

Larger cities, with ever-greater complexity, will require increased levels of control to coordinate freight flows, and possibly eliminate extraneous vehicle movements. The situation today in many cities is sub-optimal with, on average, trucks plying less than half-full and many businesses receiving numerous deliveries over the day, when one or two full truckloads (FTLs) would suffice.

Some tried and tested solutions

The logistics sector has developed a number of solutions to these problems over the last 20 years, sometimes in partnership with the public sector. Consolidation centres serving a variety of sectors have sprung up mainly across Europe on the edge or outside of a city. Here, goods bound for the same location can be aggregated and stored until the optimal time for delivery, often during off-peak periods. By bundling deliveries, it is possible to double the average truck utilization (from the current 40-45%), effectively halving the number of freight-related vehicle movements, especially during peak times. While consolidation centres have a proven record of improving delivery accuracy and timeliness, they generally need a direct government subsidy and/or other economic incentives.

Joint enterprises between the public and private sectors are likely to offer new solutions to new urban logistics problems. The private sector develops technological innovation, which enhances current processes, an example being DHL's Smart Truck which allows freight deliveries not only to be tracked but planned and updated in a real-time environment. Each route is constantly recalculated based on traffic flows and is optimized for incoming pick-up requests so that trucks can avoid congestion. This advancement allows demonstrable improvements in customer satisfaction while reducing the total cost of delivery. Other eco-mobility solutions are emerging at the local level in cities, with the use of cargo cycles permitting near-zero carbon deliveries.

Technology also promotes greater integration and collaboration between different providers. Local carriers can become part of an urban logistics system via online auction. The global penetration of smartphones offers new possibilities of logistics solutions customized for individual citizens. Other future trends will converge and shape logistics activities within megacities, such as the Internet of Things, Big Data, Radio-frequency Identification (RFID) supply chain solutions and also the proliferation of e-commerce.

Logistics for tomorrow

The question then comes: how can all this innovation come together in a meaningful and practical way? Forecasting and planning for the impact of urbanization and as a result, reshaping logistical flows, is a mammoth task demanding ever greater consultation and collaboration.

DHL's Solutions & Innovation department has responded by leveraging its Partner Network: a web of experts covering a broad range of disciplines, from smart technology to behavioural analysis. Technology partners include the likes of IBM, with its expertise in traffic prediction and management, and Siemens, which is contributing know-how in automation and sequencing for next-generation warehouses. Some research projects begin with a focus on one aspect of the city system but are then replicable elsewhere: for example, T-Systems and SAP are jointly innovating quayside slot management for the Hamburg Port Authority with technology and new processes that can be applied both to other ports and other delivery areas.

An example of collaborative joint research into city logistics is the DHL-led consortium that has analysed freight flows in several cities on behalf of local governments since 2011. These include Chengdu, China's fourth-largest city and home to more than 11 million people; Ningbo, the city with the second-largest sea port in China; and Istanbul, a gateway city bridging Europe and Asia.

Research institutes themselves provide deep knowledge and technological breakthroughs that both the private and public sectors can utilize. For instance, MIT's Center for Transportation and Logistics has experts in nano-logistics at the street level, particularly in Central and South America. MIT also runs an AgeLab, analysing the differing needs of ageing demographics across the world, which will have a major impact, not the least in India and China. DHL has been supported by the Eindhoven University of Technology through a study of game theory to understand how greater collaboration can be forged between logistics carriers undertaking last-mile deliveries.

This century offers a unique opportunity for global consultation and a sophisticated community of non-governmental and non-profit organizations now exists that offers a platform to share best practices and link service providers with new markets. DHL engages with a number of NGO partners: the World Economic Forum, with its specific interest in the responsible growth of future cities; and the World Business Council for Sustainable Development and the International Council for Local Environmental Initiatives (ICLEI) for knowledge exchange on sustainability and resilience. The focus will increasingly be on devising new investment models, allowing for cost-effective implementation in real-world scenarios.

So what lies ahead? As urbanization firmly establishes these new economic powerhouses at the heart of our political, cultural and economic life, what remains to be seen is to what extent the prevailing business models and paradigms will have to adapt to meet the complex demands of the new generation of megacities. There is every reason to be optimistic as ever-strengthening partnerships and joint analysis bring forth innovative ideas and create new, sustainable business models enabled by smart technologies.

Additive Manufacturing and Supply Chains

Yossi Sheffi
Elisha Gray II Professor of Engineering Systems and Director, Transportation and Logistics, Massachusetts Institute of Technology (MIT), USA

Much has already been written about the effect of additive manufacturing, also known as 3D printing, on the future ability of consumers to manufacture their own devices at home. Most of the "home machines" spray thin layers of plastic resin one after another, until the layers add up to an object (hence the name "additive manufacturing"). The method, however, is also likely to replace significant portions of traditional industrial manufacturing. The technology involves a bed of material – which can be a mixture of alloys – and a computer-controlled laser which shoots a beam into the bed to melt the material according to a computerized blueprint, building ultra-thin layers of material one by one. The technology has several significant advantages over the traditional methods of casting, machining and welding.

Benefits and challenges for logistics

With 3D printing, manufacturing complexity is no longer a constraint for hardware designers. The technique can be used to manufacture any shape, including complex hollow structures which are difficult to forge otherwise. Similarly, variety can be enhanced since the parameters of the computerized blueprint can be changed from item to item. This is likely to lead to a huge increase in consumers' desire for customization.

The resulting explosive increase in stock-keeping unit (SKU) count is likely to lead to significant challenges for logistics and distribution. However, other characteristics of the technology are likely to mitigate this effect. The first is that the machinery is smaller and more compact than that needed for traditional manufacturing. Add to this the fact that fewer and less-skilled operators will be needed and the result is that manufacturing sites can be located closer to consumer locations. Furthermore, the technology allows for shorter lead time for manufacturing (once the computer blueprint is given), and the result is shorter supply chains and less need for large inventories. As the lead time between retail consumption and manufacturing shrinks, manufacturers and retailers can tighten delivery schedules and adopt just-in-time procedures while increasing service levels.

Another impact both on sustainability and transportation is the reduction in waste – of both material and packaging. During the manufacturing process, the technology uses the exact amount of material needed and creates zero waste. Furthermore, as items are made more and more "to order," the packaging can be designed to fit the item exactly. In fact, companies like Staples have already invested in machinery to create exactly-fitting packages for items ordered from Staples.com, resulting in not only less packaging waste but very positive customer response.

The full vision of additive manufacturing is not yet technologically feasible but scientific breakthroughs in this field are occurring rapidly. Significant uses to date include: (i) rapid prototyping, where the ability to manufacture "one-offs" quickly accelerates product development processes; (ii) the manufacture of spare parts which obviates the need for end-of-life production runs with the resulting inventory implications; (iii) making prostheses where the ability to fit exactly is of paramount importance. As mentioned above, resin-based products can already be made almost anywhere.

Interestingly, leading manufacturers are starting to use the technology even for volume production due to the ability to create complex parts. CFM International, GE's joint venture with Snecma, the French aviation giant, is developing a new jet engine, LEAP, using 3D printing. GE is committed to start delivering 25,000 such jet engine nozzles a year starting in early 2016. The raw material for the new nozzles is cobalt-chromium powder.

In addition to the manufacturing benefits of using less material resulting in lower costs, the new parts are expected to be lighter than parts based on traditional manufacturing methods, leading to fuel savings for the airlines using the new engines. According to a recent article in MIT Technology Review magazine,[5] many other manufacturers are watching GE. It is the first big test of whether the technology can revolutionize the way complex high-performance products are made at scale. The implications for supply chain operations, however, are likely to be more important when the technology is used for shortening supply chain lead times; for using small-scale manufacturing locations close to markets; for spare parts manufactured on an "as needed" basis; and for customization of products. Hundreds of companies large and small are developing and perfecting this technology, which is likely to mature very quickly.

The Rising Threat of Cyberattacks to Logistics Networks

John Manners-Bell
Chief Executive Officer,
Transport Intelligence, United Kingdom

Although supply chain risk is now firmly on the corporate agenda after a series of catastrophic natural disasters, it is not the only threat that executives and politicians are coming to terms with. Criminals, terrorists, security agencies and so-called hactivists are increasingly targeting the information and communications technology (ICT) systems of large corporations and government agencies. The logistics and supply chain industry is finding itself increasingly in the line of fire.

For many decades, logistics companies have invested most of their time and money into ensuring the integrity of their physical infrastructure and assets. Airlines and express operators have, for instance, been very mindful of the risks to their business of a terrorist infiltration of a bomb on board an aircraft or into a shipping container. Physical screening of consignments and the validation of shippers is commonplace. The major logistics companies also have huge security operations in place to prevent theft of shipments from their warehouses, the substitution of counterfeit goods or the use of their networks to move illegal drugs or firearms around the world.

Threats to IT systems

Less attention has been paid, however, to the possibility of an attack on their information technology (IT) systems, which, depending on the source of the threat, could have consequences ranging from the inconvenient to the catastrophic. The risk is very real – according to the Verizon 2013 Data Breach Investigations report, 15% of those companies actively targeted were in the transportation sector.

Supply chains dependent on sea freight are perhaps uniquely exposed to cyberattacks due to the way in which shipping is increasingly channelled through the ever-decreasing number of ports capable of loading and off-loading the largest container ships. For example, a successful cyberattack on a port community system (a system responsible for the coordination of all port activities) of one of the big “gateway” hubs, such as Rotterdam or Los Angeles, would have a substantial region-wide economic impact due to the lack of options available for re-routing of ships. Shipping is increasingly reliant on IT – from navigation to propulsion, from freight management to traffic control. With the development and deployment of e-freight and e-maritime systems, the risk is only going to get worse.

The airline and air cargo sectors are also at risk. Future aircraft designs developed to deliver efficiency gains will be based on network connectivity and electronic data exchange. This will make the industry ever-more reliant on the transfer of real-time automated data from ground to aircraft. If the systems were compromised, there could be disastrous consequences for the safety of the crew, passengers and cargo. The same goes for air traffic control systems. Ensuring that these data are transferred securely between the ground and aircraft is a challenge that all stakeholders in the civil aviation sector must address.

The logistics industry also faces threats, not so much to the control of transport assets, but to the goods themselves which are being moved or stored. In terms of data, supply chain networks could be described as being inherently insecure, with parties encouraged to share information with suppliers and customers. The availability of data heightens the risk that the integrity or confidentiality of that shared information could be compromised. Supply chain management systems facilitate the dissemination of shipment-level information which, while enabling the efficient movement of goods, is also invaluable to criminals. The widespread use of hand-held devices and GPS technology in the field is only increasing the risks. Companies understand and manage this risk internally but have difficulty identifying and managing it across a large supplier base.

Changing attitudes to cyber threats

Regulators are slowly waking up to the fact that transport and logistics IT systems are vulnerable to attack, as well as to the severe consequences for commerce and society should air, sea, road or rail transport networks be disrupted. Although its inquiries are at a very early stage, the European Union may require that transport operators have backup systems in place for computer systems that will allow swift recovery of core activities, especially relating to the safety of transport, should a cyberattack occur.

The changing attitude to cyber threats can be summarized by the comment of one transport security expert, who noted that while five years ago he was spending most of his time on the physical aspects of security, now the majority of his time is dedicated to technology and data-exchange issues. It is clear that looking forward, the focus for the transport and logistics sector as a whole must be as much on the integrity of its data streams as on the physical aspects of its systems.

Barriers to Improving Global Supply Chain Performance by Using "Big Data"

Hugh Donald Ratliff
Regents Professor and Executive Director,
Supply Chain and Logistics Institute, Georgia Institute of Technology, USA

The age of big data has clearly arrived in the supply chain world. It is now possible to capture huge amounts of data regarding shipments and transportation assets as they move through supply chains around the world. The question that is yet to be resolved is: what must be done to extract real value from this data? There is agreement that two actions are a must: First, this data must somehow be pulled together from disparate sources and organized into some useful form. Second, there must be analytics developed that (a) provide insights into the performance and limitations of supply chains to at least identify where improvement potential exists and/or (b) aid decision-makers in determining what actions to take to improve supply chain performance.

Providing information about the status of supply chains in some meaningful way seems the most obvious use of this big data. Much of the data is being generated to provide status information about individual transportation assets (ships are tracked throughout the world and their positions given on sites such as www.searates.com, for instance). Containers are tracked and their last-known positions provided on websites by virtually all container lines (e.g. Maersk). Packages are tracked by parcel delivery companies, (e.g. UPS and FedEx) and customers are given updated expected delivery times. However, all this information relates to individual transportation assets or shipments and says little or nothing about the status of the supply chains or the global transportation networks. There is limited information available to tell a company when a container port is experiencing labour problems or congestion that might cause their containers to be delayed. It is also difficult for companies to know which routes from origin in one country to destination in another are faster, more dependable or more cost-effective for moving their products.

Practical uses

It is interesting to note that the results of analysing big data have become much more widely available to individuals wanting to know the status of passenger transportation networks and to optimize their use of these networks, than to companies moving massive quantities of expensive freight through global supply chain networks. For example, the TSA website provides details of the status of security lines at United States airports, allowing passengers to better plan their arrival time. A variety of websites provide information on flight delays. Google provides indications of the traffic flow on major US roads to enable individuals to plan their routes. Waze is a particularly interesting iPad app that gives information about traffic conditions derived from data supplied by users. Some cities have websites that provide information on parking availability. The growth in this information on the status of passenger networks is phenomenal.

An intriguing question is why similar information is not available to support the optimization of supply chains. Several reasons seem plausible:

- Many supply chain stakeholders do not really understand what value they could get from better utilizing big data.
- Much of the potential value would come from sharing data, much as Waze users share data for the common good. However, companies that own the data are hesitant to share it.
- Shared data requires that there be some neutral data repository that aggregates, organizes and makes the data available in some useful form. No such repository currently exists.

A planning aid

While individuals often utilize network status information for real-time decision-making, it seems more likely that companies can get more value from the use of big data for planning rather than real-time execution, at least initially. For example, an individual who learns from an app on her phone that her route is congested may immediately choose an alternative route suggested by the app. For shippers, this kind of "real time" adaptation to network conditions is often not possible for particular shipments such as ocean containers once they are in transit.

However, forecasts of the time required for each route based on current network status would be of great value in both selecting routes and in determining when to ship. Knowing the average time required for each route would enable companies to select routes that minimize in-transit inventory. Knowing the variability in transit time would enable companies to select routes that minimize safety stock. Currently, too little information is available to allow companies to optimize the design of their supply chain networks in this way. Among the benefits that could be obtained from sharing big data are: managing and reducing in-transit inventory; cutting safety stock and stock-outs by having more accurate estimates of the variability in transit time; optimizing routings of shipments; finding equipment surpluses and deficits to avoid empty repositioning costs; and identifying ports that have poor performance with respect to transit time and variability.

Reluctance to share data

While individuals are often eager to share data, companies typically feel that data sharing might result in a loss of competitive advantage. This seems a "chicken-and-egg" problem. Companies do not want to share data unless there is proof that they will get value from the sharing. However, it is very difficult to prove the value without first sharing the data. Regarding who might host a big data repository, both for-profit and not-for-profit possibilities exist. GTNEXUS, CargoSmart and INTTRA are examples of companies that provide collaboration platforms that collect at least part of the data required and would be logical repositories for a profit-based data system. An entity such as the World Bank would also be a good choice if a sufficient number of companies are willing to contribute their data and have it publicly available at a nominal fee.

The fact that global supply chains are becoming increasingly complex and are continually changing is perhaps the strongest argument for attempting to utilize big data to improve the visibility of network statuses. Even the largest multinational companies have difficulty trying to understand and manage global networks. For small and medium-sized companies, this is virtually impossible. The result is that supply chains are often much less efficient in terms of both operational cost and inventory required than they should be.

Adapting Logistical Systems to Climate Change: The Challenges Ahead

Alan McKinnon

Professor and Head, Logistics,
Kühne Logistics University, Germany

In its 4th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) acknowledged that, "Even the most stringent mitigation efforts cannot avoid further impacts of climate change in the next few decades which makes adaptation unavoidable."[6] To date, however, most of the research and debate on climate change has focused on mitigation, with the aim of reducing the rate of global warming to an environmentally sustainable level. Given atmospheric and ecological time lags, even if a dramatic de-carbonization of human activity were to be achieved today, it could take many years for this to have a noticeable effect on global climate. Regardless of the long-term effectiveness of carbon reduction measures being adopted today, it will be necessary, for the foreseeable future, to adapt our logistical systems and supply chains to the stresses of a climate-changed world. There is mounting evidence that these stresses will be greater than previously thought.

The extent of warming and its effects

To the surprise of many climate scientists, the rise in average global temperatures over the past decade has not been as pronounced as some of their models had predicted, despite a steady rise in greenhouse gas concentrations over this period.[7] Estimates of climate sensitivity to these concentrations may therefore have to be revised downwards at a global level. At continental, national and regional levels, however, climatic conditions appear to be changing quite rapidly, particularly in the Arctic where the minimum summer ice cover has drastically shrunk in recent years. It averaged 8 million square kilometres during the 1970s, but in 2012 was only around 3.5 million square kilometres, 18% less than the previous record low set in 2007.[8] At this rate of shrinkage, it is possible that the Arctic could be ice-free in the summer within 10 years.[9]

The ice cover acts like a giant mirror reflecting sunlight back into space, and as it is gradually replaced by dark ocean water, the rate of heat absorption by the atmosphere accelerates. The resulting warming of the Arctic region, which is already twice as fast as for the planet as a whole, is being associated with the increasing frequency, intensity and duration of extreme weather events, such as the droughts, flooding and storms experienced in the northern latitudes over the past few years. In 2012, 3,527 monthly weather records for heat, rain and snow were broken in the United States.[10] One must always exercise caution in linking extreme weather events to longer-term climate change, but a large body of scientific opinion is now convinced that these links exist and pose a major threat.

Non-linear impacts

Many climatic and ecological projections, as well as government environmental policies, assume steady incremental changes in climate over a long period will give us time to adjust – and to prevaricate in international climate change negotiations. There is now growing concern in the scientific community that climate change and its related environmental effects may prove to be "non-linear." The climatic record suggests that when certain thresholds (or "tipping points") are crossed, abrupt changes in climatic conditions can occur within a few decades or even years. The world may not, therefore, have the luxury of adjusting gradually to a warming planet.

So what are the implications of all this for logistics? The prevailing view of many logistics managers is that climate change is just another risk factor to build into their business continuity and resilience models. Allowance is already made for bad weather in the management of supply chains and all that may be required is a bit more contingency planning to accommodate extreme weather conditions. Longer-term climate impacts, most notably sea-level rise, are considered unlikely to pose a serious threat to logistics systems for many decades and are left to future generations of managers to deal with. These views may prove to be rather complacent.

Several forms of climate change adaptation relating to logistics merit greater attention today:

1. "Climate proofing" of transport infrastructure: The climatic tolerance limits within which much transport infrastructure has been built will need to be widened to cope with the adverse effects of global warming. These effects are likely to include flooding, subsidence, landslides, exposure of pavements, tracks and pipelines to extreme temperatures and fluctuation in water levels in canals. For example, "one-in-a-100-year" floods could become "one-in-20- or 10-year floods", greatly strengthening the socio-economic justification for investment in flood protection. Such climate-proofing will often be very expensive and, within fixed or reducing infrastructure budgets, divert resources that might otherwise have been used to expand capacity. It will also be very "logistics-intensive," requiring the movement of vast amounts of construction material. On the positive side, this will generate new business for logistics providers specialising in the transport, storage and handling of these materials. On the other hand, it will make it harder for the logistics sector to achieve absolute reductions in its global carbon footprint in compliance with national government targets.
2. Climatic stress-testing of current and future logistics systems: Many logistics systems contain facilities designed, located and built when climatic conditions were quite different from today, let alone what they will be 20-30 years from now. Companies will need to regularly assess their exposure to climate risk as some firms, such as Nike,[11] already do. As the probability of severe weather events and the scale of related damage increases, companies will have to weigh the relative costs of suffering logistical disruptions against "climate-proofing" their existing premises or, if necessary, relocating them to less vulnerable sites. For new distribution centres currently at the planning stage, full account must be taken of direct susceptibility to climate risk, such as localized flooding, but also of indirect exposure to climatic influences on the transport, energy and communication infrastructures upon which they depend.

3. Cross-sectoral impact of climate change on logistics: As logistics is essentially the servant of other industrial, commercial and social sectors, their adaptation will inevitably demand a logistical response. For example, changes in temperature regimes, water availability and disease are already causing significant shifts in agricultural zones, forcing the reconfiguration of food supply chains to a new geography of food production and distribution.[12] Meanwhile, the transformation of the global energy mix from fossil fuels to renewables and nuclear power, and the installation of carbon capture and storage systems on the remaining coal-fired power plants are likely to prove very transport-intensive during the construction phase. Wind power, for instance, requires the movement and installation of much more steel and concrete per megawatt of power than coal-fired, natural gas or nuclear power stations.[13] Once this renewable energy infrastructure is in place, much less fossil fuel will need to be moved, reducing the long-term transport-intensity of energy generation. In the next few decades, however, there will be a surge in the level of logistical activity as the energy supply system is fundamentally re-engineered.

A new branch of logistics research, which could provisionally be called "adaptive logistics," needs to be evolved. It would examine all the ways in which logistical systems will need to be modified over differing time-scales and geographies in response to climate change. It would provide logistics providers and their clients with advice on adaptation planning and help raise the profile of adaptation issues in corporate agendas. This advice would inevitably by probabilistic. Although the sophistication and predictive accuracy of climate models is steadily improving, great uncertainty remains, particularly at the regional and sub-regional levels at which many logistical systems are planned and managed. Current understanding of the mechanisms by which rising temperature affects geophysical and biological systems is also limited. It is hardly surprising that transport engineers complain that current climate modelling exercises do not given them the data they need to recalibrate their infrastructure planning tools. As logistics analysts get more involved in adaptation planning, they will no doubt suffer similar frustrations.

One could take the view that there is currently too much uncertainty about the magnitude and severity of climatic, ecological and geophysical changes to formally develop adaptation strategies for logistics. But using uncertainty as grounds for inaction is both risky and defeatist. Companies whose supply chains traverse regions likely to be severely affected by climate change and those whose products and services are particularly "climate sensitive" cannot wait until climatic modelling capabilities are fully refined. Each IPCC Assessment Report (the 5th is due in 2014), tends to narrow the range of uncertainty and forecasts future climate impacts with greater confidence. Its work is constantly being supplemented by other studies of climatic threats to business and infrastructure and the options for dealing with them. Synthesising the results of this work and translating them into practical advice for logistics managers would be worthy goals for the new field of "adaptive logistics."

Part 3: Logistics as Solutions and New Opportunities

The Role of Logistics in Reducing Post-Harvest Losses

John Manners-Bell
Chief Executive Officer, Transport Intelligence,
United Kingdom

Anne Miroux
Director, Division on Technology and Logistics,
United Nations Conference on Trade and Development (UNCTAD), Geneva

In the aftermath of the food crisis that erupted a few years ago, food security in the developing world came back to the fore, and with it issues of post-harvest losses (PHL). This is an issue of key importance to the Global Agenda Council on Logistics & Supply Chain Systems which has recently launched a project to measure the scale of the challenge and identify solutions.

PHL is not a new topic; indeed in the mid-1970s the food crisis of the time brought particular attention to the issue and led to a number of efforts by the international community. As time went by, however, and as the food crisis abated, the interest in PHL, while not completely disappearing, faded substantially. With the surge in food prices in 2007-2008 and the food security challenges faced by a number of developing regions, the question of how to feed growing populations is back on the agenda. In a world where environmental and climate change challenges are affecting the potential for continued production increases, and where sustainable development is essential, a new focus is being placed on PHL reduction.

PHL patterns

Food security problems are exacerbated by the fact that population growth is occurring in developing regions with the most inefficient infrastructure and fragile economies and societies. This means that an increasingly large proportion of the world's population will be located in high-risk areas, where a poor harvest or conflict could result in disaster.

Empirical evidence on the extent of post-harvest food losses is scarce and estimates vary substantially, between countries and regions as well as between different types of products. Some estimates for average losses in East and Southern Africa, for instance, put PHL for grains at 10-20% (in term of weight loss), with some regions reaching as high as 25-35%.[14] In South-East Asia, PHL for rice has been estimated at 37%.[15]

The causes for these high levels of PHL in developing countries are many and varied, and manifest themselves at any point between harvest and consumption. Some of them are technical in nature, including poor harvesting and handling practices; inadequate techniques for drying and monitoring moisture levels; lack of appropriate storage leading to bio-deterioration or pest attack; and inefficient transportation. Other causes include poor marketing and distribution policies and inadequate financial infrastructure that affects, for instance, the ability of producers to get payments for their goods or to finance their activity.

Perishable produce such as fruits and vegetables register higher PHL than other commodities. Indeed, livestock products, fish, fruit and vegetables are most at risk due to poor standards of refrigeration. Most fresh produce in many developing countries is transported in an unpackaged form and is often sold in markets where poor handling dramatically reduces its shelf life.

PHL despite technological advances

Technologies are available to help producers in developing countries address some aspects of the problem and deal more specifically with, for instance, on-farm PHL. Through such technologies or techniques, the quality of inputs (such as seeds and pesticides) can be improved, and cultivating methods or handling practices enhanced. For example, small-scale dryers and specific bagging techniques have shown interesting results.[16]

In spite of these developments and the efforts that have been made in a number of regions, the problem of PHL remains acute. One of the core reasons behind the persistently high level of wastage is the extreme level of fragmentation involved in both production and food supply chains as a whole – all the way from harvesting to handling, threshing, drying, storing, transporting, performing quality control, processing, packaging, marketing and distributing to final consumption. In many developing countries, a number of these operations are generally handled by different actors. Agricultural production is often dominated by small farmers who have limited access to technologies and financial resources. They do not possess, for instance, the equipment required to ensure proper temperature at storage and there is a lack of understanding of how to efficiently handle produce. Fresh fruits and vegetables are particularly vulnerable in that respect and systems controlling temperature and humidity are usually necessary to ensure proper conservation. However, in many developing countries, especially in South-East Asia and Sub-Saharan Africa, the infrastructure required to achieve this is lacking.

In addition, small farmers are often poorly integrated with local markets (not to mention international ones). Marketing channels to supply urban markets are often disorganized and complex, involving traders, middlemen and wholesalers, leading to enormous inefficiencies. On top of this, transport systems and warehousing are often undeveloped, as a result of which transport costs are particularly high in rural areas. The World Bank estimates that transport costs per ton-kilometre from farm to primary markets are 3 to 5 times higher than those from secondary to wholesale markets in capital cities. Road infrastructure, in addition to lack of competitive and high-quality transport and logistics services, plays an essential role. Transport cartels, or roadblocks, are one reason for the high transportation costs prevailing in large parts of the African continent, affecting domestic as well as intraregional trade.

The way forward

Some countries have begun to pay particular attention to improving their transport and logistics services. Rwanda, for instance, has made logistics services one of its priorities and has begun to register a reduction in transport costs.

At the heart of the problem is the lack of value within the supply chain. Indeed, if there is no improvement in the transport and logistics systems, there is no incentive for farmers and other partners to invest in new infrastructure and processes for PHL reduction: the extra costs will only make the end product uncompetitive. Counter-intuitively, it makes more sense for farmers to absorb the loss of a large proportion of their crops.

Consequently, an improvement in food production and productivity (higher yields), although important, is unlikely to be sufficient on its own to increase food security dramatically. There must be improvements in all segments of the food supply chain and this includes fundamentally how products are moved to market – that is, the role of logistics and transportation. A value chain approach is key to addressing the issue, of which logistics and transport is an essential link.

One solution is to develop innovative ways in which farmers themselves can process their products, for instance by using mobile milling plants housed in shipping containers, as is being done by a public-private initiative being rolled out in Sub-Saharan Africa. This would both incentivize and enable farmers to invest in ensuring their product arrives safely at the market. This should be coupled with efforts to encourage the development of high-quality and competitive logistics and transport services, including through policy reforms. Eventually, this could create a microeconomic environment in which transport companies could afford more modern trucks and in which a cold chain could develop. This, combined with education, training and government investment in transport and energy infrastructure, could start to have a very real impact on what is presently an unsustainable situation.

A Multifaceted Approach to Achieving a Conflict Mineral-Free Supply Chain

Tony Prophet
Senior Vice-President, Supply Chain Operations, Personal Systems Group (PSG) Worldwide, Hewlett-Packard Company, USA

For more than a decade, the mining of minerals used to produce tantalum, tin, tungsten and gold (3TG) in the Democratic Republic of Congo (DRC) has been linked to the funding of armed groups waging a civil war in the country. These metals are widely used in the components and assembly processes of electrical and electronic products. Hewlett-Packard (HP) finds unacceptable the possibility that its products contain metals that fund armed conflict, and is taking a leading role to establish conflict-free sources of 3TG.

This issue has received attention as a result of campaigns by non-governmental organizations (NGOs) as well as its inclusion in the US Dodd-Frank Wall Street Reform and Consumer Protection Act. In August 2012, the Securities and Exchange Commission (SEC) adopted a rule that implemented a requirement in the Dodd-Frank Act that publicly-traded companies disclose by 31 May 2014, the use of conflict minerals originating in the DRC or adjoining countries. However, there is risk that the Dodd-Frank Act requirement may cause widespread exodus of trade from the region, thus worsening the plight of the local population. HP sees a window of opportunity to capitalize on the current level of heightened concern and establish the governance framework needed to enable transparent, conflict-free mineral trade in the DRC.

HP takes the issue of conflict minerals very seriously and has developed a multifaceted approach to combating the issue, which includes conducting due diligence in its own supply chain, driving consistency and common solutions for the industry, and working hard to prevent an embargo of minerals from the DRC.

Supply chain due diligence

All along its supply chain, HP scrutinizes both its first-tier suppliers and the smelters identified by these suppliers that process mineral ores into metals. The company has asked its first-tier suppliers to provide information about the smelters they use, adopt a DRC conflict mineral-free policy and set the same requirements for their own suppliers.

This year, for the first time, HP is publishing the identity of the 3TG smelters and refiners that have been confirmed as being part of its supply chain. HP believes there may be other smelters and refiners that are yet to be identified and plans to update this list in the future.

Consistency and common solutions across the industry

HP is taking an industry-leading role to create practical solutions that enable responsible sourcing of minerals. In 2010, the Electronics Industry Citizenship Coalition (EICC) and Global e-Sustainability Initiative (GeSI) Extractives Work Group launched the first Conflict-Free Smelter (CFS) programme. This programme independently audits smelters and refiners to determine if they are sourcing DRC conflict-free minerals. HP has been a member of the CFS programme audit review committee since its inception. HP also helped to develop the Conflict Minerals Reporting Template to facilitate the common exchange of information between suppliers and the smelters used in their supply chains.

Avoiding an embargo through closed-pipe projects

HP has also been working to mitigate a de facto embargo on minerals from the DRC. The company is committed to using metals produced from "closed pipe" projects as they are available. These metals, which directly benefit local communities, are available through programmes such as the Solutions for Hope Project and the Conflict-Free Tin Initiative. To establish a complete conflict mineral-free supply chain, a mineral must be certified at the source and during the chain-of-custody process in the DRC. Creating a validated supply of minerals from mines to smelters poses significant challenges. Because there is no way to distinguish minerals from different mines, a form of secure traceability at all stages from mine to smelter is needed.

In addition to the operational work outlined above, HP advocates policies that will encourage conflict-free sources of 3TG from the DRC. With this objective, the company engages widely with policy-makers, regulators, NGOs and other stakeholders.

Coordinated action required

The deep-rooted problems in the DRC require coordinated action by the business, government and NGO community. HP is focusing on achieving progress through multistakeholder forums that facilitate that type of collaborative approach. HP offers not only its perspectives, but also commits resources to education, administration and the development of tools to validate mineral sources.

HP was encouraged that its efforts garnered recognition by two NGOs active in the DRC and the conflict minerals sphere. In its report "Taking Conflict Out of Consumer Gadgets: Company Rankings on Conflict Minerals 2012", the Enough Project named HP one of four companies that have been "pioneers of progress". HP also ranked second out of 24 consumer electronics companies assessed by the organization. In addition, HP received a letter from Free the Slaves – an NGO dedicated to ending all modern forms of slavery – that recognized HP's work with the US State Department to resolve issues in the DRC.

During 2013, HP will continue pursuing its campaign for conflict-free minerals through the initiatives outlined above. The journey towards conflict-free minerals for HP and all companies sourcing these minerals will take time. The key to achieving the company's goals is growing the number of CFS-compliant smelters. When a critical mass of CFS-compliant smelters is attained, HP plans to require its suppliers to source only from those smelters.

Potential of Retail Logistics in India: A Perspective

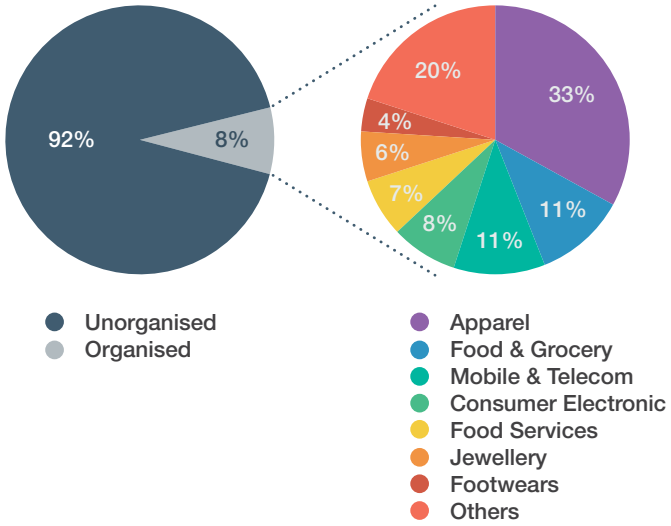
Vineet Agarwal
Joint Managing Director,
Transport Corporation of India, India

The Indian retail sector is the fifth largest in the world, and accounts for 14-15% of the country's GDP. The industry size is expected to more than double from US$ 450 billion to US$ 1.3 trillion by 2020, propelled by an estimated 25% average annual growth in organized retail if overseas investment is permitted in the sector.

Organized retail penetration and key trends

In developed countries, the organized retail industry accounts for almost 80% of the total retail trade, whereas in India it currently hovers around 8%.

Figure 1: Organized Retail Industry in India



Source: Dunn & Bradstreet retail sector overview, India Retail Report 2013, Images Group

Factors driving growth of Indian retail sector

1. Emergence of nuclear families
2. Growing trend of double-income households
3. Increase in disposable income and customer aspirations
4. Increase in expenditure on high-value and luxury items
5. Expanding working population
6. Growing liberalization of India's foreign direct investment (FDI) policy and entry of global brands
7. Increase in brand consciousness

Logistics spend by retail sector

The sector spends about 6% of its revenues on logistics, and over half of this spend is incurred on transportation.

The retail-fast moving consumer goods (FMCG) sub-sector in India outsources different logistics functions at varying levels to Logistics Service Providers (LSPs). Transportation is outsourced by almost the entire industry, while only around 15% of value-added logistics is outsourced. This degree of logistics outsourcing is significantly higher than in the electronics industry.

Current state of retail supply chains

According to the World Bank's 2012 Logistics Performance Indicator, India is ranked 46th and is behind countries such as Japan, the United States, Germany and China. Logistics costs account for around 6-10% of average retail prices in India as against the global average of 4-5%. Therefore, there is a clear scope to improve margins by 3-5% by improving the efficiency of the supply chain and logistics processes.

India is the second largest producer of fruits and vegetables in the world but, according to the *India Tribune*, due to inadequate supply chain and logistics infrastructure and management, two-thirds of the produce, worth US$ 65 billion in revenue, is wasted or lost in transit every year.[17] In the last few years, India has also been crippled by rising food inflation rates, predominantly due to high supply chain costs in the Indian food and grocery industry, estimated at US$ 24 billion. When it comes to temperature-sensitive transportation and storage, the gap is more glaring. According to industry analysts, improving the back-end processes in the supply chain and integrating cold chains can save US$ 15 billion annually while reducing the wastage of perishable horticulture produce and ensuring additional export revenue of over US$ 5 billion.

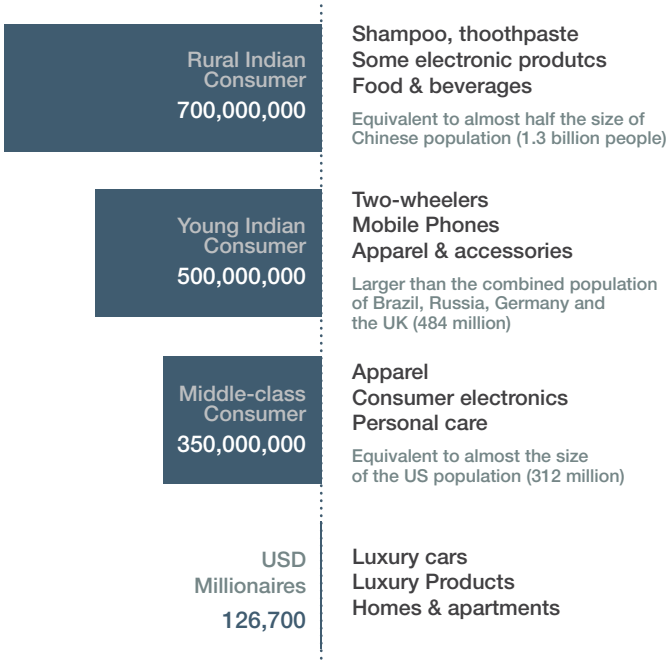
In India, 65% of freight traffic moves on the road network. Road freight volumes have increased at a much higher rate than the growth of the road network over the last few years, creating structural issues of capacity and quality. Complex taxation and the use of different road permits/documents in different states impose additional constraints on the movement of freight by road. In the financial year 2009-2010, the total length of toll roads in India was only 8,502.48 kilometres, about 2% of national highways in the country, according to the TCI-IIMC joint study "Operational Efficiency of Freight by Road in India"[18].

Another challenge is the deep penetration of "unorganized" (or traditional) retail in India. Nearly 92% of the retail market is unorganized, relying heavily on delivery by bullock cart, bicycle, van and so on. Dependence on these means of transport is going to remain prevalent for quite some time yet.

As PricewaterhouseCoopers (PwC) notes, "India has a large and aspirational middle class of 75 million households or 300 million individuals. Often referred to as the growth engine of the Indian economy, the middle class wants products which provide value for money. … India's rural population of 700 million presents an opportunity for retail and consumer (R&C) companies, which they cannot ignore."[19] Much of this population currently relies on "unorganized" forms of retailing. "The agriculture sector has been witnessing record foodgrain output, giving a boost to agro-industries and rural incomes. This is creating opportunities for retail development in rural areas. But, penetration levels for several products such as personal care, hair care, skin care, consumer durables and electronics are still quite low in rural India," PwC notes. Those R&C companies that are customizing products for the Indian market, in terms of pricing, packaging and promotion, will be in a strong position to capture much of this expanding market.

Figure 2: The Power of Indian Consumer Groups

Major demographic groups are driving purchases across categories



Source: PzC analysis
*Capgemini, Merrill Lynch Wealth Management
** Income levels for middle-class consumers, according to the NCAER, range from INR140,000 to 780,000, which using a conversion rate of USD1 equivalent to INR45, is IUSD3, 111 to 17,333.

In spite of these impediments, the Indian logistics sector has come a long way in a very short span of time, although India still has a long way to go when compared to international standards. The use of Information Technology (IT) and of innovative IT-enabled logistics functions is, nevertheless, growing exponentially.

Retail logistics and supply chain transformation

A 1996 report commissioned by the United Kingdom government reviewed and summarized some key elements of this retail logistics transformation.[20] Six closely related and mutually reinforcing trends were identified:

1. Increased control over secondary distribution (between warehouse and shop)
2. Restructured logistical systems
3. Adoption of "Quick Response" (QR)
4. Rationalization of primary distribution (factory to warehouse)
5. Increased return flow of packaged material and handling equipment for recycling/reuse
6. Introduction of Supply Chain Management (SCM) and Efficient Consumer Response (ECR)

In the United Kingdom and some other developed countries, these trends are now at an advanced stage.[21] In many parts of India, they are just emerging.

Role of supply chains in organized retail

Indian supply chain practitioners would benefit from the creation of a professional council/association to provide advice and support, and to explore the particular logistical challenges facing retailers in India.

Supply chains in the organized retail sector in India should be mutually-supportive partnerships between retailers and manufacturers. An initial focus of these partnerships should be the reduction in what is euphemistically called "shrinkage," which will increase top- and bottom-line growth.

Partly because of inadequacies in India's transport infrastructure across all modes, retail supply chains tend to have higher inventories, making the location and capacity of warehousing a major aspect of supply chain operations. Indian retailers are, nevertheless, trying to reduce transportation costs and investing in new logistical systems, directly or through partnerships. As the Indian organized retail sector is growing, it is extending its control over the supply chain in an effort to cut costs and improve service quality. This is helping it wrest market share from the unorganized retail sector composed of local kirana/ mom-and-pop stores.

In India, many retailers still equate logistics with transportation and overlook the importance of other activities such as warehousing, inventory management, courier operations, client servicing, B2C deliveries and other valued-added services such as packaging.

Potential of retail logistics

Elsewhere in the world, retail chains outsource much of their logistics to third-party providers. The Indian retail industry and logistics service providers (LSPs) need to forge partnerships to:

- Build temperature-controlled supply chains
- Create of total supply chain visibility from point of production/ origin to point of consumption through the use of advanced IT
- Reduce shrinkage
- Improve inventory management – in-transit and at distribution centres
- Develop consolidation and packing centres
- Merge back-end supply chains for multiple retailers
- Manage reverse logistics operations
- Enable B2C deliveries for online retailing and TV shopping channels

The Indian logistics industry is potentially at the cusp of a major transformation. Logistical change would be hastened and extended by the advent of major foreign retailers into the Indian retail market, though many of the current infrastructural, investment and fiscal constraints will remain for the foreseeable future.

Conclusion

Supply chain management is playing a critical role in the expansion and modernization of the Indian retail sector. Competition is intensifying and consumers are becoming ever more demanding. New logistics systems will be required to support the new forms of "organized retail" developing in India, but, for the foreseeable future, their development will be constrained by deficiencies in transport infrastructure and regulation.

Asia-Pacific Supply Chains: What to Learn and Unlearn

Jonathan Wright
Managing Director, APAC Management Consulting-Comms, Media and Technology Sector, Accenture, Singapore

The writer thanks Olivier Jankelovics for his significant help with the development of this article.

Is there any point strategizing for an Asia-Pacific supply chain? After all, the Asia-Pacific (APAC) region is not like North America, whose regulations and political climates are largely consistent across the continent's many regions. Nor is Asia-Pacific like Europe, where a compact land mass (barely larger than Australia and less than one-fourth the size of Asia) makes transportation and distribution less complicated.

The reality is that the region is so diverse, so big and so much in flux that it is almost impossible to think in terms of an integrated Asia-Pacific supply chain. Consider the following intra-Asia contrasts and their implied effect on supply chain management:

- The 2012 Enabling Trade Index identifies Singapore as the world leader in developing "institutions, policies, and services facilitating the free flow of goods over borders and to destination." Hong Kong ranked 2nd, China 56th, Thailand 57th, Indonesia 58th and India 100th.[22]
- While some countries in the region apply a value-added tax (VAT), others assign a goods and services tax (GST), with rates varying from country to country. Japan's VAT is 5%, South Korea's is 10% and India's is 13.5%. Singapore's GST is 7%.[23]
- Assessing countries that are "easy to do business with," South Korea ranks 8th out of 183. Japan is 20th, China is 91st and India is 132nd.[24]
- Malaysia ranks 20th in the world in "labour market efficiency". Thailand holds 50th place, South Korea is 76th and the Philippines is 113th.[25]
- Almost one-third of China's GDP comes from manufacturing. India and Thailand also are manufacturing centres. Australia, on the other hand, is primarily a service economy and its major industry is mining.

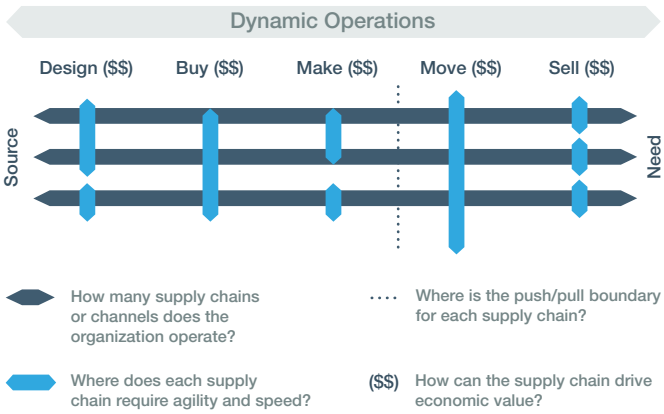
In addition to these disparities, trade lanes have expanded dramatically. Throughout most of the 20th century, APAC's supply chain flows went largely east-to-west, with countries with low-cost labour manufacturing low-cost products for export. More recently, however, APAC countries with an emerging middle class have become demand points, which has prompted the flow of more products imported from developed nations in Europe and North America. Plus, as APAC economies grow, more companies based in Asia (or those with Asian subsidiaries) are manufacturing products for use in their own, and in other, Asian countries.

So how does one address all these complexities and evolutionary changes with one supply chain? The obvious answer is: one does not. After all, the term "supply chain" implies a straight line and a singular operating mode – efficiently moving goods by leveraging tight linkages, and smooth handover from mode to mode and location to location. But across the Asia-Pacific, these goals are often unrealistic. APAC's extreme diversity points to the need for multiple supply chains that are: 1) tailored to the requirements of specific regions and communities; 2) supported by locally-developed capabilities and talent; and 3) agile enough to accommodate the region's continuous, rapid change. So what one may actually be looking for is a less tightly-integrated, more flexible, non-linear coalition of supply chains. Accenture refers to this concept as Dynamic Operations.

The basics of dynamic operations

Think of Dynamic Operations as a loose-knit group of networks (of design, sourcing, manufacturing, distribution, commercialization, etc.) whose flexibility helps a company navigate unpredictable markets (Figure 3). In places like APAC – where key capabilities may be less mature and/or less ubiquitous – processes at any node can be modified or largely reinvented. Likewise, when market opportunities arise or disruptions occur (supply interruptions, financial turmoil, market shifts, weather disturbances, etc.), Dynamic Operations give companies more power to respond quickly.

Figure 3: The Concept of Dynamic Operations



Source: Accenture, "Dynamic Operations: Supply Chain Innovations for the Era of Permanent Volatility"

The concept of Dynamic Operations implies a group of supply chain nodes or networks that reorient themselves as needed without upending a company's desired cost/service balance.

Four capabilities make Dynamic Operations possible:

Agile Execution: Rapidly adjusting supply chain actions by varying capacity up and down, improving collaboration, formulating supplier contingency plans and implementing advanced technology such as predictive analytics. The mantra is "flexible resource allocation," made possible by an elastic infrastructure.

Adaptable Structure: Creating products, processes and systems that are easily modified in response to changing conditions. The best and clearest example may be flexible manufacturing: the ability to respond quickly to currency fluctuations, supply disruptions and sudden demand shifts by altering manufacturing volumes, mixes and venues.

Insight to Action: Sensing, capturing and analysing external and internal data and turning it into usable business intelligence. In effect, companies use information to improve their ability to buffer risk while swiftly leveraging new opportunities.

Flexible Innovation: Making design and development processes less rigid by reducing changeover times, increasing interchangeability, designing products that embrace multi-channel networks and technology, and structuring ways to smoothly and rapidly rebalance order management, production and warehousing in response to shifting conditions.

Challenging basic assumptions

Dynamic Operations is a largely new paradigm that – in places like APAC – may require companies to reconsider (or even refute) several long-standing supply chain orthodoxies. Here are some examples:

Integration: To accommodate APAC's vastness and complexity, it may be beneficial to concentrate less on "integration" and more on "dynamism" – creating less interdependent but more responsive ecosystems of processes, people and technologies. A good example is basic logistics: across the Asia-Pacific, integrated transportation strategies are often hobbled by the immature condition of rail and water transport and intermodal infrastructures. As a result, companies could benefit from somewhat more insular approaches and (due to the difficulty of controlling end-to-end flow paths) new ways to optimize the supply chain.

India's Future Group manages more than 30 distinct supply chains: from household goods to white goods and fresh foods to fashion. Bullock carts and handcarts are as much a part of this picture as sophisticated trucks; and the company's stores often have more in common with the chaos of traditional bazaars than the manicured aisles of developed-world retailers. In effect, Future Group relies on integrated operations where possible, but acknowledges the periodic need for free-standing approaches.

Centralization: Strong centralized management may work well in Europe or North America, both of which are characterized by greater consistency, political stability and regulation. But in places like APAC – where there is more uncertainty and volatility – centralization can be counterproductive. This does not mean that centralization is totally unwarranted in APAC. Pan-Asia command posts or control towers can be an important real-time monitoring tool. But in a larger sense, decentralized operations can be a better way to deal effectively with cross-border challenges, taxation differences, geographic obstacles, technological variations and labour discrepancies. Think in terms of more dynamic, tailored models such as country-based transportation management or regional (or sub-regional) customer service approaches. The idea is centralized oversight and analytics combined with decentralized execution.

In China, regulatory and taxation programmes are broadly decentralized. National retailers such as RT-Mart have responded by developing more decentralized operations, which tend to be more effective than the centralized management practices used by large international retailers.

Make versus buy: In western economies, leading-practice companies often keep their core competencies in-house and outsource other functions to third parties. In effect, they "make" what they're best at and "buy" the rest. In APAC, this approach may not work because not a lot of large-scale third parties can deliver consistent, region-wide services. The challenge, therefore, is either building lots of in-house operations or a complex network of service providers (cobbling together hundreds of smaller operators to provide comprehensive service or cover a large geographic area). The latter option is why practitioners of Dynamic Operations may develop dual-sourcing or even multi-sourcing strategies and foster tighter relationships with tier-two and tier-three suppliers. In a volatile environment, companies can reduce risk by knowing – and working more closely with – their "suppliers' suppliers."

A large conglomerate in Thailand could not find enough high-quality logistics service providers to handle inbound movement of raw materials and supplies, and outbound transport of finished goods. The company therefore decided to create its own internally managed third-party logistics (3PL) services focused on serving all the organization's divisions and ensuring consistent service quality and price.

Enterprise IT: Pan-enterprise systems are not irrelevant in the Asia-Pacific. However, successful APAC operations may often give precedence to customized technology solutions designed to address local needs (for example cloud solutions, portable devices and customized applications). Concentrating on regional capabilities, talent and people-driven innovations may also be more important than building or enhancing giant systems.

Every day within a four-to-five-hour window, Mumbai (India) dabbawalas (food provisioners) provide workers with some 200,000 lunch boxes. With no enterprise systems governing their operation, the dabbawalas still operate at 6-Sigma level. The key is well-trained locals who use an elaborate coding system that denotes point of origin, starting train station, ending train station, building location and floor, and handling instructions.

Low touch: Vast distances, multiple modes and low logistical sophistication imply that, in many parts of the Asia-Pacific, frequent handling is unavoidable. As a result, businesses may need to figure out how to smoothly and cost-effectively procure, price, move and sell products when multiple handoffs – everything from boats to bicycles – are the norm. Tightly integrated and automated distribution systems may also be less attractive because many APAC countries' labour rates are low and there is less standardization of materials handling equipment.

Acknowledging the inevitability of frequent handling operations, Reliance Industries built and manages a complete supply chain ecosystem for its Jamnagar refinery. The company chose an underdeveloped coastal city in India, created a port and road network, built a desalination plant to ensure water supply, and trained villagers to become welders and electricians.

Just-in-time: Volatile demand, rapidly diversifying product offerings, uneven infrastructures and inconsistent third-party services can make it extremely difficult for companies to rely on just-in-time strategies and solutions. In many cases, more inventory and fewer stock-keeping units (SKUs) might be preferable ways to maximize availability and revenue. APAC manufacturers may also have to find more company-specific inventory management approaches that align with market and logistics conditions, as well as the capacity situations of their suppliers.

In India, Honda and Toyota are two of only a few companies that use just-in-time practices. They understand that supply uncertainties are high, so they maintain higher inventory levels than in Japan. Still, when the Japan tsunami and Thailand floods struck, auto-parts supplies to India stopped and both companies lost market share to their competitors.

New directions in APAC supply chain management

The Asia-Pacific region's growth potential – as a global source of manufacturing and supply, and as a market for locally- and internationally-produced goods – is almost incalculable. The region is likely to remain highly diverse, at least in the short term. New priorities and operational philosophies, often somewhat counter-intuitive, may reign for the foreseeable future. The need for flexibility could trump the importance of integration, and accommodating frequent handling may be a higher priority. Smart relationships and top talent will often supersede smart systems.

To deal with these likelihoods, many APAC companies will need a confederation of operating models – flexible, multi-directional Dynamic Operations. Only then could they sense and respond to rapidly changing situations in order to grow and evolve at different paces, at different times, in different locations and in different ways.

The key is agility – creating, adjusting and continuously optimizing APAC-tailored networks in response to changing market, political, financial, technological and supply chain-specific events.

Endnotes

1. World Economic Forum, Bain & Company and the World Bank (2013) "Enabling Trade: Valuing Growth Opportunities" http://www3.weforum.org/docs/WEF_SCT_EnablingTrade_Report_2013.pdf.
2. World Economic Forum (2012) "The Global Enabling Trade Report 2012: Reducing Supply Chain Barriers" http://www3.weforum.org/docs/GETR/2012/GlobalEnablingTrade_Report.pdf.
3. Ibid.
4. INECON (Ingenieros y Economistas Consultores) for Dirección Ejecutiva del Proyecto Mesoamérica (2012) "Estudio de Comercio en el Área de Influencia"
5. Martin LaMonica, Breakthrough Technology, MIT Technology Review, Vol. 116, No. 3 pp. 58-59.
6. Intergovernmental Panel on Climate Change (2007) "Fourth Assessment Report: WGII Impacts, Adaptation and Vulnerabilities", Geneva.
7. The Economist, "A Sensitive Matter", 30 March 2013.
8. Vidal, J. and Vaughan, A. "Arctic Sea Ice Shrinks to Smallest Extent Ever Recorded", The Guardian, 14 September, 2012.
9. Roach, J. "Arctic Largely Ice Free in Summer within 10 Years?" National Geographic News, 15 October 2009.
10. Natural Resources Defense Council (2013) "Extreme Weather Map Shows 3,527 Monthly Weather Records Shattered in 2012" http://www.nrdc.org/media/2013/130115.asp.
11. Wong, J. and Schuchard, R. (2012) "Adapting to Climate Change: A Guide for the Consumer Products Industry" BSR, San Francisco.
12. International Food Policy Research Institute (2009) "Climate Change: Impact on Agriculture and Costs of Adaptation", Washington DC.
13. Petersen, P.F. (2006) "Current and Future Activities for Nuclear Energy in the United States, presentation to CITRIS Research Exchange", University of Berkeley.
14. APHLIS in World Bank, Natural Resources Institute and FAO (2011) "Missing Food: The Case of Post-harvest Grain Losses in Sub-Saharan Africa".
15. FAO (2011) "Estimated post-harvest losses of rice in South East Asia".
16. World Bank, Natural Resources Institute and FAO (2011) http://siteresources.worldbank.org/INTARD/Resources/MissingFoods10_web.pdf.
17. India Tribune, "India loses $65 b. annually due to poor logistics: Report"
18. Transport Corporation of India (TCI) and Indian Institute of Management (2012), "Operational Efficiency of Freight Road in India", Calcutta
19. PricewaterhouseCoopers (2011) "Winning in India's Retail Sector: Factors for Success" http://www.pwc.in/assets/pdfs/rc-publications/WinningSector.pdf, Haryana, India.
20. McKinnon, A.C. (1996) "The Development of Retail Logistics in the UK: A position Paper" Technology Foresight Programme, London.
21. Fernie, J., Sparks, L. and McKinnon, A.C. (2012) "Retail logistics in the UK: past, present and future" International Journal of Retail Distribution Management, 38, 11/12.
22. World Economic Forum (2012) "The Global Enabling Trade Report 2012: Reducing Supply Chain Barriers" http://reports.weforum.org/global-enabling-trade-report-2012.
23. United States Council for International Business (July 2012) http://www.uscib.org/index.asp?documentID=1676.
24. The World Bank http://www.doingbusiness.org/rankings.
25. World Economic Forum Global Competitive Index, 2011-2012 http://www.weforum.org/reports/global-competitiveness-report-2011-2012.

Bibliography

Accenture (2012) "Dynamic Operations: Supply Chain Innovations for the Era of Permanent Volatility" http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Dynamic-Operations.pdf.

APHLIS in World Bank, Natural Resources Institute and FAO (2011) "Missing Food: The Case of Post-harvest Grain Losses in Sub-Saharan Africa".

FAO (2011) "Estimated post-harvest losses of rice in South East Asia".

Fernie, J., Sparks, L. and McKinnon, A.C. (2012) "Retail logistics in the UK: Past, Present and Future", International Journal of Retail Distribution Management, 38, 11/12.

India Tribune, "India loses $65 b. annually due to poor logistics: Report"

INECON (Ingenieros y Economistas Consultores) for Dirección Ejecutiva del Proyecto Mesoamérica (2012) "Estudio de Comercio en el Área de Influencia"

Intergovernmental Panel on Climate Change (2007) "Fourth Assessment Report: WGII Impacts, Adaptation and Vulnerabilities", Geneva.

International Food Policy Research Institute (2009), "Climate Change: Impact on Agriculture and Costs of Adaptation", Washington DC.

LaMonica, M. "Breakthrough Technology", MIT Technology Review, Vol. 116, No. 3 pp. 58-59.

McKinnon, A.C. (1996) "The Development of Retail Logistics in the UK: A Position Paper" Technology Foresight Programme, London.

Natural Resources Defense Council (2013) "Extreme Weather Map Shows 3,527 Monthly Weather Records Shattered in 2012" http://www.nrdc.org/media/2013/130115.asp.

Petersen, P.F. (2006), "Current and Future Activities for Nuclear Energy in the United States, Presentation to CITRIS Research Exchange", University of Berkeley.

PricewaterhouseCoopers (2011) "Winning in India's Retail Sector: Factors for Success" http://www.pwc.in/assets/pdfs/rc-publications/WinningSector.pdf.

Roach, J. "Arctic Largely Ice Free in Summer within 10 Years?" National Geographic News, 15 October 2009.

The Economist, "A Sensitive Matter", 30 March 2013.

Transport Corporation of India (TCI) and Indian Institute of Management (2012), "Operational Efficiency of Freight Road in India", Calcutta

United States Council for International Business (July 2012) http://www.uscib.org/index.asp?documentID=1676.

Vidal, J. and Vaughan, A. "Arctic Sea Ice Shrinks to Smallest Extent Ever Recorded", The Guardian, 14 September 2012.

Wong, J. and Schuchard, R. (2012) "Adapting to Climate Change: A Guide for the Consumer Products Industry" BSR, San Francisco.

World Bank (2012) "Doing Business Economy Rankings" http://www.doingbusiness.org/rankings.

World Bank, Natural Resources Institute and FAO (2011) http://siteresources.worldbank.org/INTARD/Resources/MissingFoods10_web.pdf.

World Economic Forum Global Competitive Index, 2011-2012 http://www.weforum.org/reports/global-competitiveness-report-2011-2012.

World Economic Forum (2012) "The Global Enabling Trade Report 2012: Reducing Supply Chain Barriers" http://www.weforum.org/reports/global-enabling-trade-report-2012.

World Economic Forum, Bain & Company and the World Bank (2013) "Enabling Trade: Valuing Growth Opportunities" http://www3.weforum.org/docs/WEF_SCT_EnablingTrade_Report_2013.pdf.

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

The World Economic Forum is an independent international organization committed to improving the state of the world by engaging business, political, academic and other leaders of society to shape global, regional and industry agendas.

Incorporated as a not-for-profit foundation in 1971 and headquartered in Geneva, Switzerland, the Forum is tied to no political, partisan or national interests

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel +41 (0) 22 869 1212
Fax +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org