KAPSARC
مركز الملك عبدالله للدراسات والبحوث البترولية
King Abdullah Petroleum Studies and Research Center

Freight Energy in Transition:
Disruptors and Enablers

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About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is a non-profit global institution dedicated to independent research into energy economics, policy, technology and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

This publication is also available in Arabic.

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Key Points

An increase in freight activity across different modes of transport has resulted in an amplified policy focus on reducing the associated externalities of increased transportation energy consumption, pollution, and traffic congestion (especially for urban freight). Increased freight energy demand in growing economies has placed further significant pressure on policymakers to reduce associated oil demand by focusing on multimodality, digitization, the aggregation of freight, and intensifying the exploration of alternative fuels to diesel, the transport fuel of choice. However, a lack of policy coherence has meant that solutions are often implemented without recognizing the context of specific situations. The need for a detailed exploration of policy scenarios is especially critical as freight evolves, driven by multiple factors from economics to security.

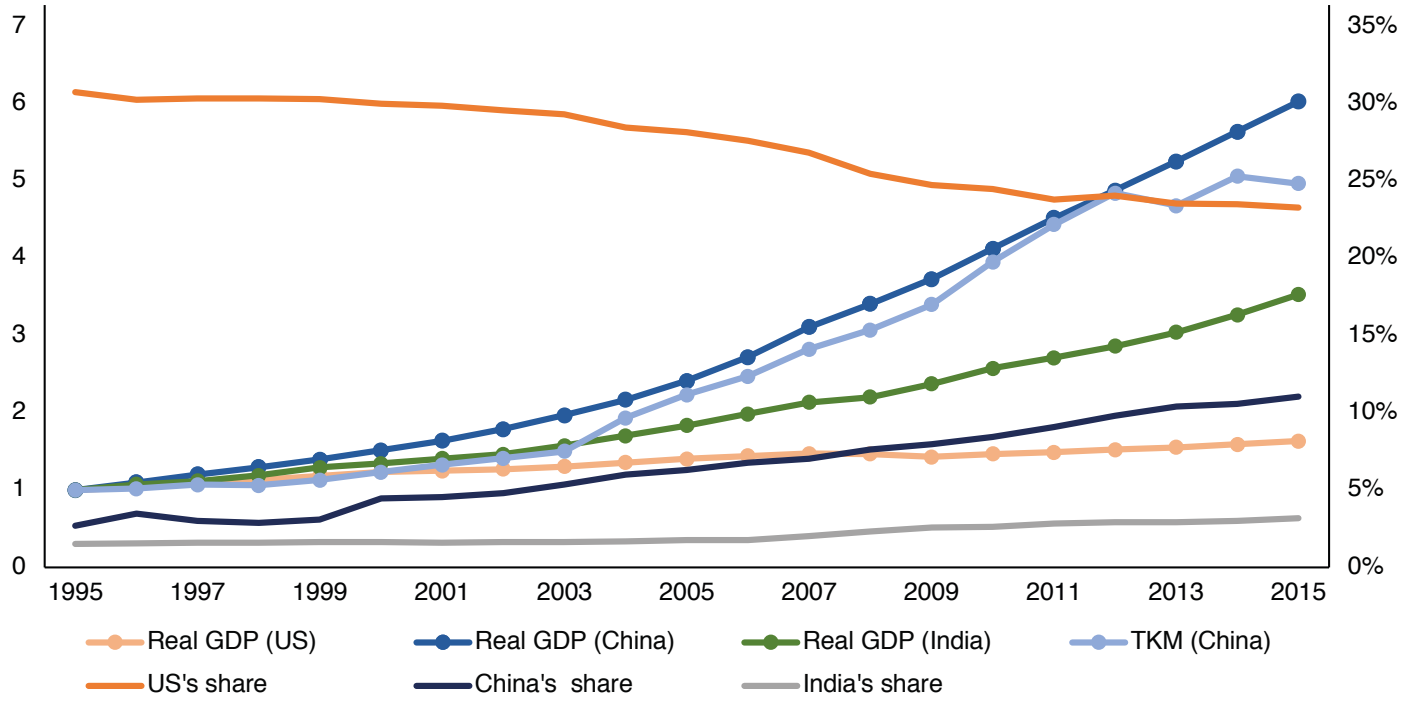
An intensified focus by policymakers on urban freight, to reduce congestion in cities and improve their air quality, has not been successful. This is primarily because the limited gains made by these policy measures have been negated by the growth in freight volumes resulting from increased consumer demand. These policy measures will need to be reassessed using new technologically innovative tools.

Freight aggregation through digital innovation was identified as a significant enabler of transportation energy savings. However, it has had only partial success in delivering the expected results, primarily because of the fragmented nature of the road freight sector and data availability issues across the logistics chain. Market solutions have helped to consolidate cargo and improve the formalization of the trucking industry. However, the massive scale of the infrastructure investments required has overwhelmed market participants, limiting efficiency gains.

Increased demand for raw materials and consumer goods from growing Asian markets will require localized policy solutions. The development of regional, transnational and international partnerships requires developing comprehensive security frameworks, investing in logistics infrastructure, standardizing freight solutions, and sharing policy lessons. These partnerships include the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC), the Regional Comprehensive Economic Partnership (RCEP) and China's Belt and Road Initiative.

Key Points

Figure 1. As national GDP has increased so has the share of freight transportation in overall energy consumption (index 1995=1).



Source: KAPSARC analysis.

Note: Constant GDP using 2010 US$ from the World Bank.

Summary

The rapid evolution of freight has often stymied policymakers working on freight transportation energy demand. The freight sector is seldom studied in depth, because the passenger side of transportation energy demand usually takes precedence, resulting in a limited understanding of policy ramifications for freight. A greater public awareness of climate and related energy aspects has forced policymakers to address issues such as urban traffic congestion, increasing freight-related emission issues impacting urban air quality, and the need to balance economic forces through policy measures ranging from off-hour deliveries to multimodality and alternative fuels. However, a much more nuanced understanding of the issues involved by all stakeholders is required for the freight industry to absorb these policy shifts.

Economic drivers are forcing the freight sector to innovate. E-commerce and the pressures of timely delivery have meant that last-mile delivery has morphed from a mass delivery system through retail chains to a more direct consumer delivery system. This shift in consumer behavior has already impacted freight systems, with organizations using smaller freight delivery to cater to this new demand. This change provides policymakers with the opportunity to leverage their increased access to delivery data to experiment with various policy options like off-hour delivery, tax and other incentives to encourage consumers and freight industry stakeholders to modify their behavior, and testing electric vehicles for freight use.

As data becomes more accessible with the increasing penetration of technology, the formalization of the freight trucking market could help to generate additional information that could benefit policy design, such as a better understanding of vehicle miles traveled and insights regarding driver/consumer behavior.

The blending of data insights on consumer and freight behavior, which have ramifications for both inland and ocean freight, could help policymakers devise better policy actions across different modes and transport routes. Such policy measures could also help address the externalities associated with freight transport.

Economic development initiatives like the Regional Comprehensive Economic Partnership (RCEP) and China's Belt and Road Initiative are helping trade evolve, even as, globally, businesses grapple with economic uncertainties. The security frameworks needed to strengthen trade-based economic activities are becoming increasingly critical to ensuring that freight transport can not only expand into new regions but can also function in an era of increased market integration.

The political economy associated with freight is becoming increasingly complex, as global trade wars coevolve with the expansion of regional trade blocks. Political barriers to regional connectivity have broken down globally, helping to increase trade and, consequently, freight. However, altering international trade dynamics also calls for a greater understanding of, and in-depth research into, the freight transport-related aspects of international trade to help understand the policy ramifications of the geopolitical impact of freight.

Background to the Workshop

On October 01, 2019, KAPSARC hosted a one-day workshop in Riyadh, Saudi Arabia, that focused on potential policy levers for the evolving freight sector. Over the last few years, the KAPSARC Transportation team has been researching the dynamics of freight energy demand in China and India to understand the impact of its evolution on transport policy. The effects of increased transportation fuel demand are of critical importance to energy suppliers such as Saudi Arabia, as both China and India are massive crude importers, with high oil demand and low domestic production. China has recently overtaken the United States to become the largest importer of crude oil, and India has overtaken Japan to become the third largest. The fuel demand from India's and China's transport sectors is a critical focus area for energy security and decarbonization.

Previous transportation workshops helped to further the understanding of the primary drivers of increased oil consumption in major oil-consuming countries like China and India. Structural economic shifts, population growth, and changes in consumer behavior have driven the growth in energy demand from the freight industry. However, policymakers are now using a mix of policy and market support mechanisms to try to influence the evolution of freight energy demand.

Policymakers are increasingly focused on four key themes, which formed the basis of the workshop:

- Enablers and challenges of urban freight electrification
- Aggregation of inter-city freight
- Inter-regional multimodal freight movement
- International freight and demand-side impact

These themes are playing out in incongruent ways in both China and India. With rising urbanization, both countries have focused primarily on the passenger transport sector to drive change in their respective transportation fuel mixes. Improving fuel standards, increased investment in public transport, and pushing electric vehicles (EVs) have been the policy options that decision-makers have taken to target rising pollution levels in their growing cities.

As we look back at recent trends, we see policymakers focusing on a mix of policy and market mechanisms to influence the evolution of freight markets. However, transport technology is evolving faster than policy, which increasingly limits the scope of policy interventions. Markets are responding more to technology advances and digital innovation than to policy signals. As a result, we are facing a scenario where policy is focused on infrastructure investments as a freight enabler, and markets are utilizing transport innovation to drive efficient freight solutions. This dichotomy has furthered the belief that neither technology nor policy alone can help resolve the issues facing freight. There has to be a mix of both technology and policy interventions to achieve policy goals.

The Dialogue Around Sustainable, Low Carbon Urban Freight

Rising urbanization, coupled with a surge in consumption in Asian countries, is increasingly influencing the development of road freight and the resultant growth in transport fuels. As cities proliferate, with increasing prosperity and rising per capita income, the demand for consumer goods has intensified, translating into increased freight demand. This escalation of urban freight transport is posing a severe challenge for policymakers. They are increasingly focused on identifying solutions to address the externalities of increased freight transportation, including growing urban traffic congestion, the rise of air quality-related issues, and road traffic-related safety issues. The assortment of policy options experimented with has included restricting the entry of heavy vehicles in cities, developing logistics parks to support intermodality, incentive structures to shift delivery times, and alternative fuel mandates, among other initiatives. Policymakers are focused on incentivizing low carbon mobility in the form of clean fuels (e.g., compressed natural gas for urban freight) to further their clean air agenda. As a result, incentives to switch to clean, alternative fuels for use in urban freight are imperative in supporting sustainability.

Policymakers have attempted to shift road freight from larger trucks to smaller freight carriers for last-mile delivery, more suitable to congested urban environments. This has been done with limited success. For example, deliveries by bike in Indian cities have led to increased traffic congestion and emission levels. Smaller delivery vehicles also often negatively impact urban congestion and exacerbate air quality issues. Countries have experimented with time limitations for deliveries by larger trucks with limited success. While the limitations have helped to reduce congestion, cities have needed to develop freight infrastructure at the city limits in the form of logistics parks or parking bays for trucks. Such infrastructure support has not been standardized across India's cities, resulting in efficiency losses. Managing the multiple externalities of rapidly evolving urban freight remains a crucial challenge for policymakers.

Alternative, fuel-efficient transport options to make urban freight sustainable, supported through policy-based and financial incentives, are critical to policy success. Several countries are exploring options for providing last mile delivery for urban freight using electric vehicles. However, the nascent stage of freight electric vehicle development has meant that this is still more a policy dream than a reality. Policies that could provide suitable solutions to the issues of congestion, sustainability, and low carbon transportation of urban freight remain distant. In their absence, the market is providing innovative freight solutions by leveraging technology.

In today's globalized world, policymakers trying to tackle the policy trilemma of low carbon transportation, congestion-free zones, and sustainable urban freight solutions have greater access to potential solutions than has previously been possible. However, the challenge is to adapt these globally accepted policy solutions to local city conditions and ensure broader stakeholder engagement in managing these policy objectives. This requires collective participation from both the public and private sectors, i.e., between policymakers and the market, to ensure that the solutions are acceptable to all. Sophisticated policy approaches, with contextual policy development focusing on local issues, tend to be better at identifying which policies would be more acceptable in a specific situation. The trilemma cannot be resolved solely through a policy-based approach but requires the engagement of market participants and the use of technology to bring about solutions acceptable to all stakeholders.

Innovations in Aggregating Freight

As road freight volumes expand due to increased demand from growing economies, low barriers of entry for trucking will exacerbate supply, resulting in empty vehicle runs and inefficiencies. For countries seeking to reduce freight energy demand, policymakers can use new technologies such as demand aggregators and freight matching services to aggregate freight demand. These solutions potentially allow truckers to be more efficient in their logistics and could also increase overall efficiencies. While new technologies make it is easier to match cargoes and trucks, the fragmented nature of the Asian trucking industry has made it challenging to provide the additional services that these truck owner-operators require, namely access to capital, secure cargo storage areas and facilities for truck operators. As these services are provided by the market, the nascent aggregating sector is in need of regulation. A lack of regulation means that, while the formalization of freight is currently limited, freight matching efficiencies result directly in reduced cargo rates for truck operators. Reduced earnings for freight operators often result in truckers leaving digital freight aggregation platforms. This poses socioeconomic challenges for policymakers, as the efficiencies that they target exert downward pressure on truckers' earnings. As road freight is a low margin business with high capital and operating costs, reducing road freight margins poses problems for operators.

Freight matching and aggregation services are dissimilar to the 'Uberization' of passenger transport. The small and fragmented ownership structure of trucking companies provides the policy challenge of needing to ensure that the efficiencies from aggregating cargo and supply and demand forecasting are balanced by remunerative rates for truckers. The increased pursuit of efficiencies must also be balanced with ensuring the earning capacities of truck owner-operators are retained.

The increased availability of road freight data can also be used by policymakers to raise efficiency standards for heavy vehicles, formalize the sector, and provide better amenities for owner-operators. The increasing availability of such data can be used to generate information pertaining to areas such as freight origin-destination, vehicle miles traveled, the driving characterisitics of truck operators that could lead to supporting the multimodality of freight. KAPSARC's proprietary tool, the KAPSARC Transport Analysis Framework (KTAF), uses open-source data from satellite imagery and primary sources. It can help policymakers by building scenarios that estimate the effects of policy measures on transportation planning, in the absence of adequate data from modes.

Freight aggregation services provide policymakers with increased access to more structured data regarding freight movement. They could lead to the formalization of the road freight sector, especially in Asian countries where the road freight sector is highly informal, with minimal discernable data on freight patterns. While internet technologies can help to reduce inefficiencies, the challenge is to regulate and manage the industry.

Multimodality in Freight – Policy Barriers

Multimodality is often perceived as a panacea for energy-efficient freight transport. The ability for cargo to move between different modes ranging from road, rail, and inland water to coastal and marine transport has been a boon for containerization. However, containerization has also meant that freight is increasingly being consolidated in road freight, to the detriment of rail. The key drivers of the increase in trucking are better road infrastructure and increased last-mile connectivity across borders. Often rail and other modes are not developed enough to be able to handle multimodality and, as a result, freight users prefer to use single-mode, primarily road, transport. Multimodal competition and the trucking sector's low margins have often made trucking a much more viable alternative than rail freight, especially if deliveries are time constrained.

A lack of policy cohesiveness, the fragmentation of responsibilities for the transport sector across several governmental entities, and the inability to leverage cross-modal strengths often reduce the opportunities to increase multimodal transport. This lack of interest in multimodal logistics solutions results in investment projects in the sector being given lower priorities by policymakers.

Multimodality is now being prioritized by policymakers seeking to reduce freight energy demand and the pressure on road infrastructure. The development of new digital technologies could help to drive sectoral efficiencies and shift some road freight to rail. Sustained investment campaigns, supported by nonfinancial and financial benefits, could help to increase the attractiveness of multimodal transport. As the growing demand for goods from Asian economies attracts trade from across the world, multimodal freight could help limit the emissions from increased freight activity and help to reduce the resultant freight energy demand.

The Political Economy of Transnational Freight

In today's World Trade Organization-enabled globalized world, international freight and the entire ecosystem needed to sustain it works by engaging with multiple stakeholders. The engagement of each stakeholder is critical to the whole logistics supply chain. As the world braces itself for further trade wars and their potential impacts on the global economy, some aspects of freight have become extremely important. The supply and demand-side dynamics of freight are also a part of a much larger political economy, which includes the security of shipping lanes and the development of regional and transnational trade blocks. Increasing freight connectivity across previously underserved areas brings about policy complexities. These include, for example, the need to invest in and develop freight infrastructure along trade routes, the impact of increased freight movement on local populations in previously remote areas, developing logistics hubs and managing regional policy challenges like ensuring sea lanes of communication, access to ports, building freight infrastructure-based development projects in play.

Markets across Asia are integrating as a result of trade pacts. This integration is taking various forms, such as petroleum pipelines connecting India, Nepal, and Bangladesh, for example. Road networks across Southeast Asia are being integrated at an increasingly faster pace, which is helping to augment and grow regional trade. China and Nepal are also developing rail networks between both countries. The development of these freight networks will need to be supported by increased regulation and a robust policy framework, which will help to identify challenges to freight integration across modes.

About the Workshop

KAPSARC convened the workshop, Freight Energy in Transition – Disruptors and Enablers, in October 2019 in Riyadh. Over 25 experts attended in the areas of transport, freight, shipping, rail, environment, academia, and policy, to facilitate a discussion on the disruptions and enablers for freight transportation. The workshop focused on Saudi Arabia, China, and India. It was held under a modified version of the Chatham House Rule, under which participants consented to be listed below. However, none of the content in this briefing can be attributed to any individual attendee.

List of participants

Fahad Al Ajlan – Ministry of Energy, Kingdom of Saudi Arabia

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About the Team

Anvita Arora

Anvita is program director for Transport and Urban Infrastructure at KAPSARC. Previously, she was the CEO of Innovative Transport Solutions. Anvita holds a Ph.D. from the Indian Institute of Technology, Delhi, India.

Jitendra Roychoudhury

Jitendra is a research fellow at KAPSARC, working on freight transport and Indian energy policy research projects. He previously worked in consulting, advising organizations on commodity flows and markets.

Xun Xu

Xun is a research associate working on KAPSARC's China future freight transport energy demand project. His research interests include freight transportation, development economics, population economics, and the Chinese economy.

About the Project

The objective of the project is to analyze the economic, institutional, and policy determinants of freight transport energy demand in China and India. Both countries have witnessed strong freight-related energy consumption growth in the past decades due to their robust economic performance, and are expected to continue to account for the majority of the world's transportation oil consumption growth in the coming decade. Additionally, both countries are top importers of crude from Saudi Arabia. Therefore, this project explores current markets for and future scenarios of transportation energy consumption in China and India, producing policy-relevant insights. Specifically, the project focuses on freight movement demand drivers among freight transport modes, freight transport modal choice, and energy efficiency technologies. This work provides an opportunity to study best practice in transport planning, to serve the needs of new infrastructure development and more efficient domestic transport energy consumption in Saudi Arabia.

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