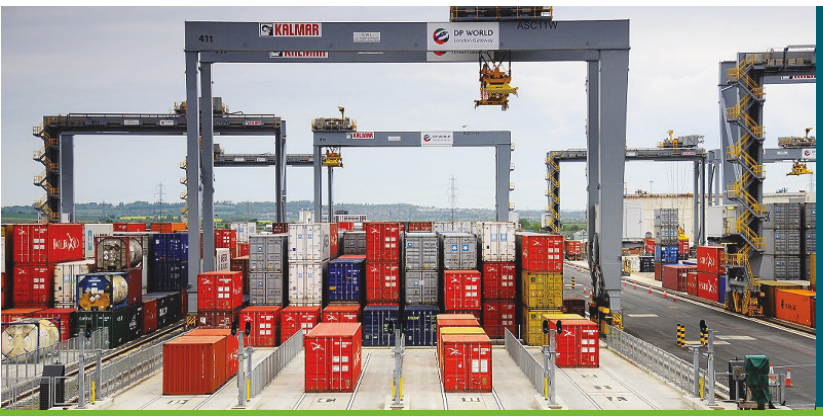
www.cepal.org/transporte

Issue No. 352 - Number 8 / 2016
English / Original: Spanish



BULLETIN FAL

FACILITATION OF TRANSPORT AND TRADE IN LATIN AMERICA AND THE CARIBBEAN

Reflections on the future of ports: from current strains to the changes and innovation of the future

Background

The port industry is under strain: it is experiencing great uncertainties, tectonic shifts in its operations, growing risks and decreasing returns, and may require new sorts of public-private partnerships and port governance in the near future. The reasons for the widespread strain (on both the government and private sectors) come from a combination of endogenous and exogenous factors (including a slowdown in world trade and weak growth in throughput).

The **endogenous factors**, those related to port affairs, originate in the public sector, in port companies and in the port industry. In the case of the public sector, existing governance models designed in the 1990s are now largely outdated. In addition, there has been misalignment between industrial and bureaucratic processes (e.g. persistent administrative problems, management inefficiencies, and so on). There has also been a growing concern for environmental, social and security issues that have a variety of effects on governance, on business management and on the level of demands placed on port operations. Terminal operators, meanwhile, are experiencing competitive tensions, as well as shorter and shorter investment life cycles and signs of decreasing productivity. At the same time, potential for port land development has gone untapped, and the industry has transitioned from a state of growth to one of value transactions, and from greenfield initiatives to chiefly mergers and acquisitions (M&A). Be this as it may, the port industry continues be attractive thanks to its investments and profitability, both globally and in Latin America and the Caribbean.

This edition of the FAL Bulletin aims to stimulate reflection on the future of ports. It describes and analyses the current strains placed on ports, and highlights areas of innovation and change that the port industry will have to tackle in the future. This topic has been chosen in light of current trends and the need to develop new strategies to keep ports in the region competitive.

The authors of this document are Ricardo J. Sánchez, Officer in Charge of the Natural Resources and Infrastructure Division, and Lara Mouftier, Research Assistant in the same Division. For more information, please contact ricardo.sanchez@cepal.org.

UNITED NATIONS

ECLAC

ISU INFRASTRUCTURE SERVICES UNIT
Natural Resources and Infrastructure Division, UNECLAC

The **exogenous factors** refer to the shipping and logistics industries, as well as the economy and trade. In the shipping industry, the tendency of the merchant fleet towards giant vessels has reduced the number of port calls and intensified peaks of activity. Furthermore, the consolidation of the industry and the expansion of global partnerships have enabled shipping companies to exert increasing pressure. Moreover, the logistics industry and port authorities have tended to address common concerns at different speeds, thus creating operational tensions.

As for the economy and trade, there have been clear signs of a slowdown in global trade and port throughput. Latin America and the Caribbean is expected to grow as a region in 2017, although moderately and with no clear drivers. The year 2016 will end with an average economic contraction of 1.1%. South America will be the worst affected subregion, with a decline of 2.4%, while the Caribbean will contract by 1.7%, and Central America will experience positive growth of 3.6%. South America is expected to rebound in 2017 with a 0.9% increase in gross domestic product (GDP), while the Caribbean is expected to grow at 1.3% and Central America will expand by 3.7%. The rate of change of throughput has gradually declined in recent years (see figure 1).

The mere presence of exogenous and endogenous factors, however, does not necessarily produce strains. The diagnosis of strain is based on two factors:

(i) The intensity of the phenomena and changes in both factors.
(ii) The intersection of these factors at a given moment in time.

In other words, multiple, very intense changes that are happening concurrently. Some of the elements in this mix are driven by innovation and changes, while others are exogenous.

Looking towards the more distant future, the challenges are be classified according to the "future matrix" (Sánchez and Mouftier, 2016). Table 1 below shows the components of this matrix.

Table 1
COMPONENTS OF THE FUTURE MATRIX

Change and innovation					
Cultural	Environmental and climatic	Governance	Geographical and territorial	Trade	Technological

Source: Sánchez and Mouftier (2016).

In a world that is highly competitive, evolving and uncertain, the willingness to change and the implementation of innovative strategies are key to market adaptation, survival and success, as well as the attainment of objectives that are common to the State and society at large. Innovation is a key element and a valuable and competitive resource for long-term development. Innovation must be given special importance and managed within businesses, ports and terminals, as well as spearheaded by the authorities of infrastructure services, of which ports and the rest of the supply chain are part.

I. Without cultural change, there can be no innovation

Innovation is largely determined by the interaction of needs, economic factors and institutional progress. Innovation holds particular importance in an industry that tends to be conservative in its processes, behaviours and forms of leadership. Cultural change is critical for innovation and for adapting to multiple new challenges, including rising volatility, the emergence of environmental, social and labour issues, as well as more rigorous standards. Investment in innovation enables greater accessibility and sustainability, more efficient use of space and heightened energy efficiency. On a social level, innovation strengthens technological knowledge, solidifies social and labour relations, and further improves productivity, competitiveness and efficiency.

In sum, cultural change, a primary engine of change and innovation, will allow the revision of traditional models that are no longer able to cope with the expansion of core activities towards new business models.

Port authorities and managers

In order to take on the challenges of innovation, it is crucial to consider both the potential and the limits of the port administrator or manager's training, requiring that skills be kept up to date in order to take on the challenges of the industry. In other words, the port manager must be able to identify opportunities and threats so as to reduce risks and convert opportunities into roadmaps for programmes and projects.

In order to foster collaboration and teamwork, the officer or port manager with expertise in the shipping and logistics business must have a clear understanding of how the entire supply chain functions, including governmental aspects (customs, immigration, health, and so on), the operations of the private multimodal transportation sector, the required workforce, both technical and operative characteristics (including the maintenance of equipment and infrastructure), as well as aspects of the logistics business (costs, freight, employment, environment, community, and so on). The manager must also understand the shipping business (costs, structure and operations, security, environmental constraints, labour issues, jurisdiction, and so forth) and the strategic

aspects of global trade. In addition, the manager must have the ability to plan, organize and coordinate port activities, as well as the actions of his or her staff. Lastly, the manager must have a client focus and an understanding of needs that allows him or her to negotiate and communicate to promote the business.[1]

The future changes in the port industry will require port managers and authorities to develop new skills, an understanding of new business thinking, and a fresh capacity to promote innovation.

II. Environmental concerns and climate change will become increasingly important for ports

As the 2030 Agenda for Sustainable Development and the Sustainable Development Goals take root in coming years, the ports of the future will place an emphasis on the substantial and growing importance of environmental conservation and climate change.[2] Given their geographical location and their economic and social roles, ports have a responsibility and duty to protect and prepare themselves for climate change in the future. Owing to their coastal location and their function as sea-land interfaces, ports will be among the first to be affected by rising sea levels and extreme weather events (Fridell, Winnes and Styhre, 2013). Frequent service disruptions are to be expected, and greater investments to protect infrastructure will be required.

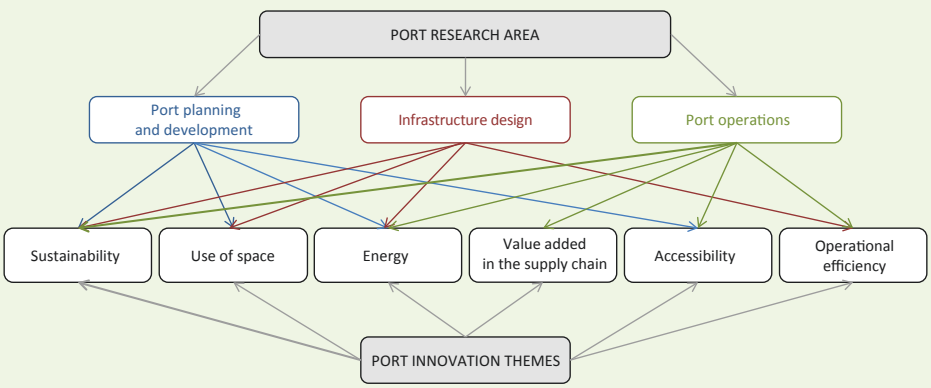
Ports will need to make strides towards greater environmental stewardship and climate resilience, as exemplified by the port of Rotterdam, which has launched a programme to become carbon-neutral by 2050. Given their importance as interfaces for the exchange of goods, ports must transform their operations to make their activities sustainable. This includes strategies to increase energy efficiency, reduce the carbon footprint, local pollutants and other emissions, reduce the water footprint, and manage waste. The port sector has only recently begun to acknowledge the importance of these issues and to discuss them. Work is now being done to establish baselines so as to measure the impacts of technological and operational progress.

Alongside logistics and mobility, a general objective for the future must be to properly internalize external costs. It has been common practice in the transportation sector to avoid internalizing external costs, be they social, economic or environmental. Environmental issues are directly linked to ports' social responsibility given that most ports in the region operate in proximity to cities, and therefore close to human populations. As such, the negative external effects (emissions, noise and congestion) have a direct and immediate impact on the population. Ports have ignored the significance of port-city interdependence for far too long.

III. Changes in governance and in social, labour and public-private relations will become key requirements for the success of ports of the future

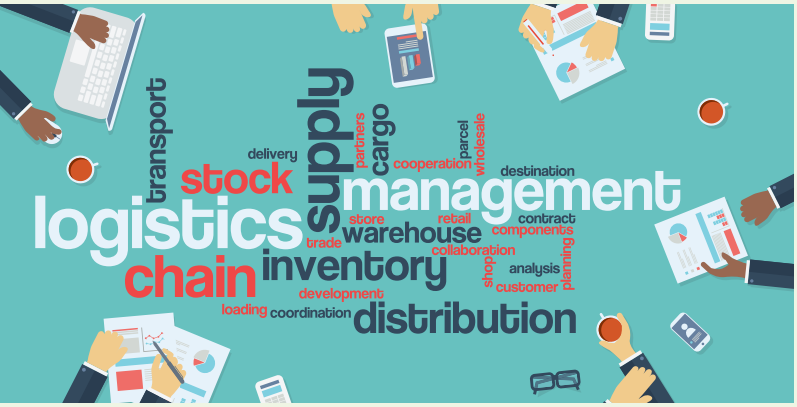
Innovation and cooperation will extend within the port community, starting with the authorities, workers, and economic and social stakeholders. There are various areas where innovation plays a part in ports, as illustrated in diagram 1.

Diagram 1
Port research and investment areas



Source: The Netherlands Research School for Transport, Infrastructure and Logistics [online] http://www.transport-research.info/programme/netherlands-research-school-transport-infrastructure-and-logistics-network.

1 Contribution by Engr. Rodolfo Sabonge, Panama.
2 http://www.un.org/sustainabledevelopment/.



Port authorities also play an important role in innovation, and driving innovation should be part of their institutional objectives. In a broader sense, the impact of innovative strategies encourages international competition and port development. A sound institutional context is a prerequisite for the design and implementation of innovative strategies. The mission of governance itself is to be a driver of innovation in social capital so that industries become more competitive globally by reacting quickly to regulatory changes and developing in a sustainable manner.

Labour relations will need to adapt to the new environment. In order to avoid the mistakes of the past, it is crucial that workers be prepared for change. Innovative ways must be found to demonstrate the context of transformation and the role of the workers themselves. In this new context, the framework for labour conditions, including training, must be reviewed ex ante, in order to help maintain positive labour relations.

A change in port governance is urgently necessary. A new form of governance is required to link up the supply chain under the umbrella of a holistic and sustainable public policy based on a systemic vision that will likely require the design of new policy instruments. Modern ports need to develop more sophisticated and complex systems of governance so that the port system can yield clear benefits to the country's economic development, and improve service delivery, efficiency, productivity and competitiveness. Objectives must be consistent with the governance model. The development of a vision and leadership that yield greater degrees of productivity, efficiency and levels of coordination is a requirement not only for the authorities, but for all stakeholders (Sánchez and Pinto, 2015).

It will be key to update and align the institutional framework with the challenges of the future. Successful structural transformations depend upon policies, regulation and barriers that either prevent or strengthen efficient port operations. The scope of action for the State and the private sector will be defined by the institutional framework, which must therefore be stable and capable of dealing with change and supporting the proposal of new standards and legislation that will stimulate port business activity. It must also enable the independent management of services within the port environment so as to encourage stakeholder involvement. Further, service deregulation and privatization fosters innovation and competitiveness. As a vector of competition it also regulates infrastructure (sea and land) and superstructure (equipment and facilities) (CAF, 2014).

Opportunities can be improved to combine competition and cooperation ("coopetition"). Taking advantage of the fact that the region has few cultural and linguistic barriers, a common system could be developed, aimed at sharing data and information, shared strategies for maintenance, purchase of inputs, advertising and so on, in a transparent way without compromising ports' natural drive to compete. Cooperation between ports and knowledge institutions will be needed to make this happen. The magnitude of changes that have occurred and are expected to happen offer the public and private sectors broad scope of action, which must be pursued in the form of enhanced cooperation and knowledge partnerships. In parallel, cooperation over information networks incorporating academia should feed into a virtuous circle to nurture innovation and thus help drive port productivity and efficiency.

Improvements in red tape and tax procedures should benefit commercial operations. Automation and interconnectivity will enable the streamlining of administrative procedures through standardization and the use of common practices. Automation itself, however, will not be enough. All port stakeholders, in particular the authorities, must foster and lead such changes, ensuring that the port and logistical environment is on board. Paper use will be reduced through such upgrading measures as single window systems, as part of a new administrative approach to port operations. Fiscal policies that favour investment in expansion and innovation, and the simplification of tax procedures —which often carry high transactional costs— will be of great importance as well.

Innovation is needed in the city-port nexus, as well. Sustainable ports can only be based in sustainable cities. Otherwise, it will be impossible to achieve harmonious integration of aligned and coordinated objectives. Strategies must begin with dialogue, leadership, planning and the governance of port cities. A valuable complement to this is the collective work carried out by networks of port cities in the region. Further, re-examining the utility of ports beyond their industrial functions will allow for the diversification of activities, including the repurposing of terminals for such uses as event centres, parks and museums.

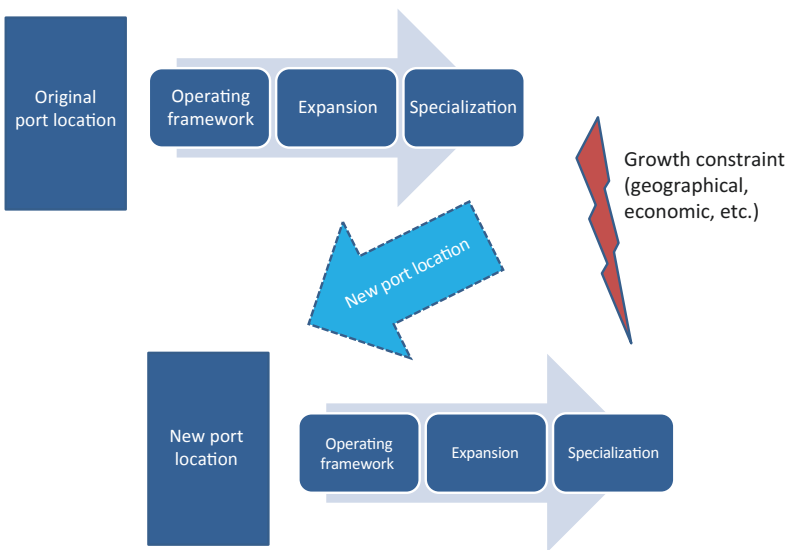
IV. Geographical and territorial changes are inevitable over time and as a result of contextual changes

A new port hierarchy is becoming consolidated the world over. This will continue, with the reconfiguration of networks and fewer port calls due to the vast size of ships and the consolidation of the shipping industry. As a consequence, new port hierarchies will emerge. Some ports that are major terminals today may begin to be served by hubs and will no longer offer direct services. This should be seen by the port community as an opportunity to rethink the national and regional port system, in which secondary ports could gain greater prominence than at present.

Foreland and hinterland: better logistical integration of the territory is essential, and will become increasingly so. The hinterland is an economic catchment area for ports as it serves as the physical and functional linkage between logistics and transportation and distribution networks. Its ability to perform those functions depends on its degree of integration and the quality of its physical and technological connections, which relate directly to issues of congestion and the capacity of infrastructure to cope with growing volumes. To achieve the efficient integration of the hinterland, common systems will be needed across the entire supply chain, linking up platforms, inland ports, intermodal terminals, freight facilities, and bonded warehouses (Wilmsmeier, Monios and Lambert, 2011). Such integration must be sustainable and will require continual investment in port facilities and connections to avoid creating ecological and social pressures. The coordination and management of market players, primarily those who hold great bargaining power, will also be a challenge. Port development, however, is largely dependent on and determined by the way the port is positioned within the wider institutional considerations at the local and regional levels. Greater connectivity benefits cities in which ports are located, both socially and economically. Structural transformations, such as technological upgrading of the storage yard (e.g. the port of Hamburg in 2010), or land reclamation (e.g. the port of Rotterdam in 2010), increase port capacity. Port development is a cumulative and discontinuous process that evolves and presents itself as a series of innovations. Thus are growth and structural transformation differentiated from one another.

Port relocation is already happening and will continue in the future, particularly in the case of older, traditional ports. The relocation of a port can renew its lifecycle once there are no further possibilities for streamlining or investing, when access becomes too limited or the port's externalities become disproportionate. Many ports are undergoing what is known as "location splitting" in response to issues such limited land endowment around traditional ports preventing expansion, multiple concurrent problems (congested highways, railways and port areas; infrastructure that is unsuitable for growing volumes; underdeveloped support infrastructure; insufficient connections with the hinterland; and rising demand for transport, among others) (Cullinane and Wilmsmeier, 2011) (see diagram 2).

Diagram 2
LOCATION SPLITTING



Source: Cullinane and Wilmsmeier, 2011.

The best practices today may be found in the port of Hamburg in Germany, where an alternative deepwater port was created (Jade Weser Port), and the port of Rotterdam (Maasvlakte) in the Netherlands. Other cases are Vancouver, Genoa, New York, Sydney or the move from Puerto Madero to Puerto Nuevo in Buenos Aires, among others.

Relocating a port involves significant challenges, however. First, relocation is a global phenomenon with local implications. The success or failure of this "structural transformation" depends on the political landscape and/or regulations and/or institutional barriers that affect the efficient and effective operations of inland terminals. The inverse strategies of logistics hubs must therefore be aligned with the operational and strategic objectives of port stakeholders.

Port relocation is beginning to occur in Latin America, given that the factors driving it are arising particularly in traditional metropolitan ports, as is the case in Mexico, Brazil and other countries.

Trade routes could be changed by shifts in major global accords. Potentially radical changes in global geostrategy —deriving from the One Belt, One Road initiative, the Trans-Pacific Partnership (TPP) and the expansion of major arteries (the Panama Canal and the Suez Canal), among others— will have an effect on demand for shipping and port services and could thus reconfigure the regional balance with respect to the situation today. Other opportunities may arise for emerging markets as a result of the strong expansion of consumer classes in less developed countries.

V. Changes are in the offing for trade and in port activity

The current trends and strategies among market actors will intensify and new ones could emerge. Despite slowing growth, ships will continue to develop in terms of both size and technology, as the current trends continue into the future. Gradual changes will also occur in shipping networks, which could affect transshipment and cargo-related operative needs. Changes in the materials transported and in final products as a result of industrial and technological evolution could also occur in the future, which, together with shifting trade patterns, will require changes in dock work. E-commerce and direct distribution could also have the same effect.

New trade and business strategies will directly impact business expansion in the logistical chain. This will occur in the context of both competition and concentration in the port, shipping and logistics sectors. The concentration of market actors will bolster their power as they come to control growing shares of cargo, thus increasing their bargaining power along the supply chain at both the regional and global levels.

While the expansion of ports offers more work opportunities, it also creates social and environmental pressures. In order to achieve a greater degree of harmony and promote sustainable development, relations with workers, communities and the environment will need to be reassessed. Investment decisions will have to be made more carefully to avoid errors of the past, such as when high growth rates produced by trade and throughput drove investment decisions that later turned out to be strategic mistakes that disturbed market conditions.

Changes in the industrial organization of port markets will increase in the future. Much as in the present, future changes to port ownership structure will bring about changes in the market balance of power for global operators and those that operate internationally, nationally and across Latin America. This could bring about industrial tensions that would prompt national authorities to subject the sector and competition to closer scrutiny.

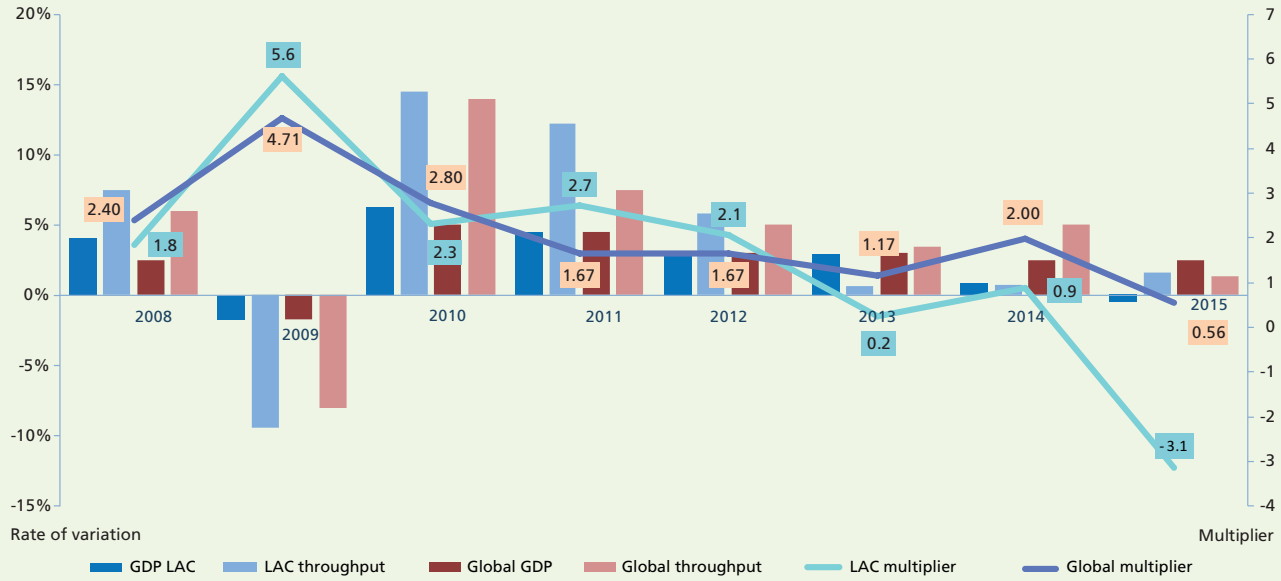
In the future, port activity, as measured by the transfer of containers, will tend to converge with variation in merchandise trade. A notable decrease is already visible in the ratio between throughput, trade and GDP at both the global and regional levels. This has been partly a result of falling rates of containerization of general cargo, which were responsible for much of the demand for container transport in the past. Trade has thus increasingly converged with throughput and this is likely to continue in the future (see figure 1).

Excess capacity in ports and shipping businesses will act as a determining factor for future trade scenarios. Given the current port market landscape in Latin America and the Caribbean, some areas could have or will generate excess capacity, something that will need to be addressed to avoid distorting competition. The concentration arising from today's excess shipping capacity could lead to problems within the port market as a result of the increased bargaining power of shipping companies relative to the terminals. By analogy, a similar situation could emerge for the logistics industry (as a result of its concentration). Looking towards the more distant future, port investment decisions will need to be made more carefully to avoid creating excess capacity.

The spectrum of the port business will continue to expand. It has in fact already evolved from traditional cargo logistics —first tier— to activities related to production and distribution —second tier (see diagram 3). This is not limited to import and export, but includes such activities

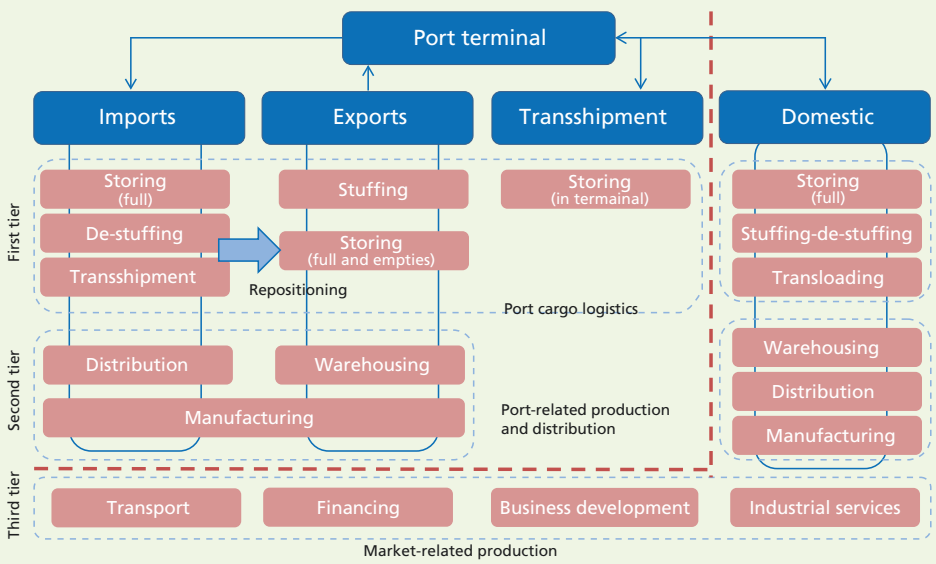
as storage, repositioning, de-stuffing, distribution and industrial activities related to manufacturing. Through regional and technological integration, activities and revenue sources are further diversified. Thus, business expands towards a more comprehensive transportation market, and also towards financing, business development, industrial service delivery, engineering, and so on, i.e. a third tier. There is also great potential for the development of businesses directed towards other markets, for example power generation or fish farming.

Figure 1
VARIATION IN GLOBAL AND REGIONAL THROUGHPUT, GDP GROWTH AND MULTIPLIER, 2008–2015
(Percentages)



Source: Prepared by the authors, on the basis of the Maritime Profile of the Natural Resources and Infrastructure Division, September 2016.
Note: LAC: Latin America and the Caribbean.

Diagram 3
Spectrum of the port business



Source: Prepared by the authors, on the basis of an original idea of J-P Rodrigue, Hofstra University, New York (2015), (https://people.hofstra.edu/geotrans/eng/ch4en/conc4en/port_centric_logistics.html).
Note: The portion of the chart delineated by red dashes represent original material developed by Rodrigue.

Gaining international competitiveness will no longer be the sole objective of large ports; instead, renewed value will be attached to their contribution to productivity growth within economies, thus increasing their economic and social impacts. A port that is integrated and focused on regionalization will use technological innovation to respond more efficiently to changes in the rules of play and in international dynamics. The interaction between systems, growing sustainability and heightened security are synonymous with improved competitiveness and sound trading conditions. Thus, technological integration and new port conceptualization will contribute positively to countries' economic development.

Clients in the supply chain benefit from enhanced trade and service conditions. The technological changes will together enable a greater understanding of port clients' needs. Optimized port operations yield better planning, save time and improve container tracking to offer a better level of service overall. As a result, port operations become more sustainable.

VI. Technological changes condition the prosperity of port activity

While smart technologies are not the only important area of innovation, they are one of the main tools and adopting them is one of the present and future challenges. The following areas of innovation are particularly relevant given that they will affect virtually all of the logistical and economic aspects of ports:

- Trends in equipment and port demands
- Internet of Things (IoT) and big data analysis
- Automation and robotics
- Sophisticated developments such as 3D printing and autonomous vehicles
- Cybersecurity

Future trends in technical progress condition continuous improvement in a context of change. The convergence of economic and technical change forms part of the technological change of the future. This raises the need to stay at the forefront of change, something that may be understood as a process of continuous upgrading that keeps productivity and technical and economic efficiency to high standard. Innovative technologies and practices are increasingly being adopted by ports and throughout the supply chain to transform organizational and administrative practices. The main drivers of investment in technological and organizational innovation include economies of scale, scope and network, globalization and competitiveness for both ports and networks within the hinterland and foreland.

The technologies of the future will generate challenges related to knowledge, education and change throughout the port industry and supply chains. When it comes to operational changes, ground transportation will be developed for horizontal movements within ports and to further connect to the hinterland. As an example, the Blok-beam will allow cost and time savings given its ability to lift and move six empty containers all at once using a single crane. Finally, the merchant fleet will also embody this evolution through the sheer size of its ships and their new technological requirements.

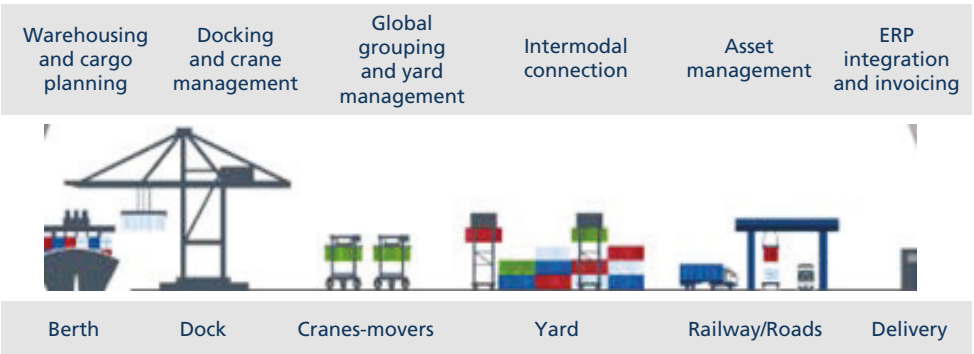
The Internet of Things (IoT) and big data will follow the same trends in ports as in other industries. The Internet of Things transforms physical objects into real-time data that is relayed within a given information ecosystem connecting all port industry activities (ECLAC, 2015).

To meet current demands for performance and profitability, terminals must be supported by an ecosystem of interconnected smart applications that gather information to further integrate processes. This will create new incentives for efficiency along other parts of the chain, such as shipping lines, port-to-port optimization, and the streamlining of value chains and a sharing economy within ports, thus offering an enhanced supply chain for the movement of national, regional and global containers. The real-time tracking of cranes and consignments, the optimization of warehouse capacity, the planned maintenance of assets, route optimization, better last-mile delivery and transits, and fleet management, among other IoT-related phenomena, will increase the efficiency and profitability of ports and will contribute to greater customer satisfaction (see diagram 4).

Automation and robotics have a sure place in the future. Automation and robotics allow for better independent control over activity, leading to enhancements in performance and security. The expansion of available information allows for more efficient monitoring and, consequently, enhances competitiveness. This generates cost savings and improves responses to one-off changes in the supply chain.

Automation is likely to increase in robots and in terminals, ships, trucks and other equipment. Real-time data analysis enables much more efficient management of operations. The greatest advantage of these processes lies in cost reduction. Another factor is the growth of e-commerce and shifts in consumer preferences. Nowadays, many consumers expect same-day delivery and to be able to personalize their orders. This puts pressure on warehouses to dramatically increase their speed and productivity.

Digram 4
INFORMATION FLOW



Source: Sánchez and Mouftier (2016), on the basis of an original idea by Rachael White, TOC, Senior logistics and transport industry analyst.

Robotics and automation have a clear presence in the future of ports. A number of reflections are called for, however. First, this future is part of the present, and automation is already a growing trend in Latin America and the Caribbean. Further, these processes do not offer single, universal solutions, but rather require a case-by-case approach to adapt to local requirements. They do, however, offer the best possible performance, and heightened cost efficiency. Today's world leaders are already showing that automated operations perform better than traditional ones. Lastly, automation requires careful technical and operational planning, and a gradual adjustment of the workforce.

Technical progress could bring more advanced changes and generate tectonic shifts in the industry. Some of the changes now under way could accelerate in the future. These refer to the supply chain, the role of technology in manufacturing (autonomous vehicles, 3D printing, applied robotics and advanced e-commerce), and the technologies and innovation applied to production and consumption patterns, which in turn could impact supply chains substantively (Drewry, 2016). Similarly, transportation technology and flow control will also undergo notable changes, such as the use of unmanned vehicles, among others. The technological advances envisaged in the future matrix include improved programming of automated vehicles and automated control (movement tracking and obstacle detection, and collaborative work by other elements within an automated system). Further, advanced e-commerce and 3D printing will also be factors of change in the new world economy. They have the potential to contribute to competitiveness and to be a differentiating factor for ports.

Along with automation, the IoT and robotics, cybersecurity is needed and will increasingly become essential. Cybersecurity is needed, first, to increase people's trust and use of information and communication technologies. Advances in automation will enable the integration of multiple electronic systems to support management and business applications, and to address inherent vulnerabilities and prevent their potential effects. At the same time, cyberattacks will multiply. Given that data are strategic elements in port and supply chain efficiency, they are extremely valuable in their own right. Accordingly, it is essential to regulate to ensure the application of legislation on the availability of information and the roles and responsibilities in and access to data for each actor in the port and logistics framework.

VII. Conclusions

The port industry is currently undergoing a period of change and it must innovate to face the challenges of the future. Above all, these change and innovation models must be pro-environment and support progress. Thus, human capital, the principal engine of innovation, will need to be a central consideration, in order to tap the opportunities that new technologies offer. The transition period must be approached as an opportunity, with openness to reconsidering specific possibilities, such as port relocation or new trade opportunities, among others. The ultimate goal is to highlight the importance of operating in a more sustainable way.

The considerations set forth in this issue of the *Bulletin* highlight the main challenges container ports will face in the future, with the aim of presenting this vision and helping ports prepare to take on these challenges successfully. A first version was released in November 2016 and was presented at a number of conferences to raise the issues and further stimulate discussion within the sector with a view to developing a common agenda. As a result, it has benefited greatly from the responses received throughout the process, which have led to the release of this revised version.

The authors wish to thank Octavio Doerr, Alan Harding, Rodolfo Sabonge and Gordon Wilmsmeier for their valuable comments.

VIII. Bibliography

CAF-Development Bank of Latin America (2014), "Relaciones interregionales", Final Report.

Cullinane, Kevin and Gordon Wilmsmeier (2011), The contribution of the dry port concept to the extension of port life cycles, Handbook of Terminal Planning, P 359-379, Springer, New York.

Daamen, Tom and Isabelle Vries (2016), "Les Crossovers Ville Port", Summary.

Drewry (2016), "E-Business Disruptions in Global Freight", White paper, November.

Fridell, Erik, Hulda Winnes and Linda Styhre (2013), "Measures to improve energy efficiency in shipping", *FAL Bulletin*, No. 324, Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).

Sánchez, Ricardo J. and others (2015), "Desafíos y oportunidades en busca de un desarrollo sostenible en América Latina y el Caribe", *Natural Resources and Infrastructure Series*, No. 176 (LC/L.4119), Santiago, ECLAC.

Sánchez, Ricardo J. and Lara Mouftier (2016), "Reflexiones sobre el futuro de los puertos", *Maritime Bulletin*, No. 64, Santiago, ECLAC.

Sánchez, Ricardo J. and Francisca Pinto (2015), "The great challenge for ports: the time has come to consider a new port governance", *FAL Bulletin*, No. 337, Santiago, ECLAC.

Wilmsmeier, Gordon, Jason Monios and Bruce Lambert (2011), "The directional development of intermodal freight corridors in relation to inland terminals, *Journal of Transport Geography*", Journal of Transport Geography, Volume 19 – Issue 6.