TRANSPORTATION INFRASTRUCTURE AND CARGO LOGISTICS MASTER PLAN FOR THE INTEROCEANIC ZONE OF THE PANAMA CANAL

by

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ABSTRACT

Approximately, three percent of international seaborne trade flows through the Isthmus of Panama. Likewise, fifty per cent of Latin American transshipment and eight per cent of import flows to the region, currently take place within the Interoceanic Zone of the Panama Canal (PMZIC). Less than one percent of these international flows are transiting or receiving services within the territory of Panama. However, its contribution to the Panamanian economy is estimated at one third of its total value.

With the aim to maximize these benefits, the Panama Canal Authority and the Government of Panama carried out the Transportation Infrastructure and Cargo Logistics Master Plan for the Interoceanic Zone of the Panama Canal. This Master Plan is the first integrated transportation infrastructure and cargo logistics planning effort in the country. The study identifies the main challenges for capitalizing on surrounding areas of the Panama Canal (around 75,000 hectares), and proposes a set of action in infrastructure, services and implementation aspects to offer an efficient platform for value added logistics to contribute to the Canal´s and conglomerate land profitability.

1. INTRODUCTION

The Transportation Infrastructure and Cargo Logistics Master Plan for the Interoceanic Zone of the Panama Canal is the first integrated transportation infrastructure and cargo logistics planning effort in the country. The need for this master plan was identified in 2015 ´by the Logistics Cabinet´s Infrastructure Committee, which is a part of the Logistics and Competitiveness Secretariat of the Ministry of the Presidency.

This committee is currently headed by the Panama Canal Authority and is composed of public institutions and logistics representatives from the private sector. The document was developed jointly with the National Logistics Strategy, led by the Logistics Cabinet.

The objective of this Master Plan is to generate long-term, sustainable conditions for the development of Panama as a global logistics hub. At the same time, to determine priorities for investment in freight infrastructure in order to provide better integration, optimizing the existing infrastructure and generating opportunities to capture new cargo segments with appropriate value-added logistic services, and at the same time to ensure the preservation of environmental resources and public and urban spaces within the Interoceanic Zone of the Panama Canal.

Through interinstitutional consultation, relevant databases were obtained from various national agencies, as well as relevant information from project developers and stakeholders within the zone as

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UABR[3], Free Trade Zones and Special Economic Areas as Panama Pacífico Agency and Colon Free Zone, Tocumen S.A., the Municipality of Panama, Miviot[4], Mici[5], Mef[6], among others. During the formulation, the study was continuously validated through four workshops, a focus group, direct and indirect interviews, and field surveys with stakeholders.

The first stage of the study consisted of an assessment of the current condition of the hub, in order to complete a gap analysis. For this, information was gathered from physical and digital inventories, interviews, secondary information and various databases.

The second stage involved the development of a multimodal transportation and logistics model that comprises Panama´s intermodal cargo flows data from 2006-2015. It also includes a costs and time model for the main logistics chains analyzed. This component captures the key elements that comprise the relevant logistics costs associated with the transport of each product segment through the study area on the main transportation modes. The model also includes a market demand module that summarizes a demand forecast for the major market segments over the time period of the analysis. This analysis is based primarily on the assessment of a base year demand, which is derived from data obtained from each of the modal options.

Demand is organized by product segment, zone of origin and destination. For future forecast years, demand matrices are estimated based on establishing causal relationships between base demand and key "drivers" of demand. This allowed the identification of future transportation infrastructure needs, as well as the actions required in order to attract potential market segments that could benefit from VALS. Finally, this analysis, along with the benchmarking of seven international logistics hubs, were utilized to establish five strategies, based on international best practices, that support the action plan.

Along with the action plan, a digital elevation model aided in the identification and dimensioning of areas with high potential for logistic developments. Additionally, an inter-institutional cooperation scheme analysis based on international case studies and local consultation was developed.

This national integrated initiative provides defined actions for the short, the medium and the long-term planning of transportation infrastructure and logistics. This initiative is based on quantitative and qualitative analyses, with the purpose of meeting future needs of both logistics projects and cargo demand flows by taking a proactive role. The recommendations contained in the PMZIC have been included as one of the pillars of Panama's National Logistics Strategy, recently launched by the Logistics Cabinet.

The remainder of this paper is organized as follows. Section 2 describes the methodology, the assessment of the hub and gap analysis based on the current state of the hub. Section 3 contains a short explanation of the development of the multimodal transportation and logistics model and main outputs. Section 4 describes the five strategies obtained for the development of the hub based on the benchmarking of seven top logistic hubs. Section 5 details the short, medium and long term action plans for the development of VALS and cargo and transportation infrastructure supported by the model results and five strategies. Section 6 contains a summary of the proposed implementation aspects that resulted from the case study analyses. Finally, Section 7 presents some final notes.

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[3] Administrative Unit of Reverted properties of the Panama Canal (UABR) was established in 2007 as a replacement for the former Inter-Oceanic Region Authority (ARI). This Unit is in charge of managing many of the buildings and areas belonging to former US military bases.

[4] Panama´s Housing Ministry

[5] Ministry of Commerce and Industries

[6] Ministry of Economy and Finance

2. **METHODOLOGY, CURRENT STATE OF THE HUB AND GAP ANALYSIS**

2.1 **Methodology**

In May, 2016, the Panama Canal the Authority awarded by public tender a one year contract for the development of the Transportation Infrastructure and Cargo Logistics Master Plan for the Interoceanic Zone of the Panama Canal to the company Louis Berger S.A.S. The study comprised 23 deliverables among workshops, reports, GIS models and a cost and multimodal logistic Excel model.

The study area initially considered the interoceanic zone (ZIC) and encompassed the administrative units of the provinces of Panama, Panama West and Colón; and the Districts of Panamá, Colón, San Miguelito, Arraiján, Balboa and la Chorrera, from Vacamonte onthe West side, to Tocumen on the East side.

The preliminary base study area was initially 149,602 hectares. Protected areas and watershed comprised 33 percent of the total area .By excluding these protected areas, the ZIC study area covered 75,754-hectare of base study area. Figure 1 shows the preliminary ZIC study area boundaries and the protected areas and water bodies.
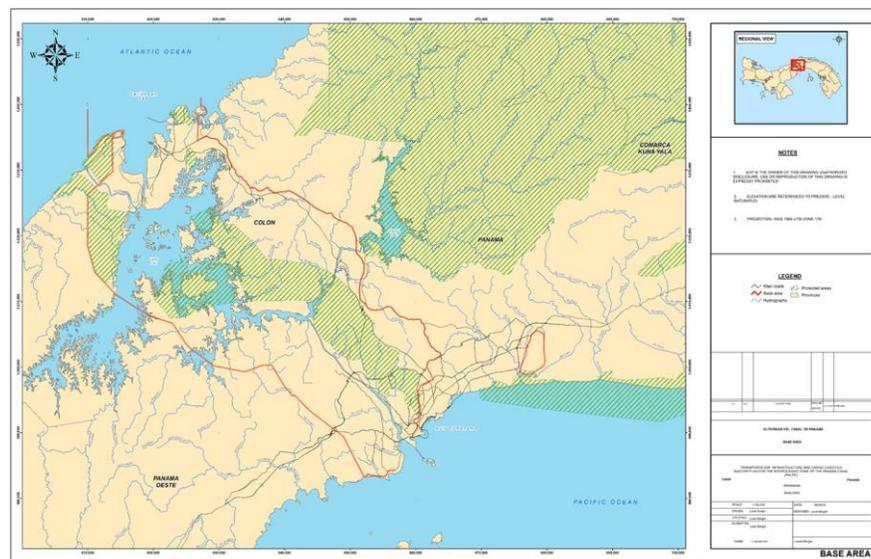

Figure 1. PMZIC preliminary study area

Four main blocks of analysis composed the PM-ZIC. The first part comprised a current situation assessment. Data collected from interviews, secondary information and databases from internal and external parties was used to build a Transportation Infrastructure Inventory in the ACP ARCGIS platform and a Panama International Cargo Flows Database in Excel.

- **Physical and digital inventory of infrastructure, transportation services and projects, Current Cargo Flows Inventory:**
  - Road network inventory: Includes 915 km of roads, with service levels, pavement conditions, and ongoing road projects with impact on the logistic platform of the ZIC. This inventory includes the results from the "PIMUS II[7]" study carried out by Metro de Panamá.
  - Railway network inventory: 72 km of railway included, equipment inventory and service levels obtained by field observation and interviews.
  - Ports inventory: ten international seaports classified by cargo type, infrastructure capacity (berths and yards), and service levels. Main data of port movements was obtained from

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[7] Plan for an Integral and Sustainable Urban Mobility by Metro de Panamá

Panama Maritime Authority Statistics Department. Infrastructure inventory from field observation, interviews and aerial photography, among other methods.

o   Airports inventory: includes four international airports with current and projected capacity. Information was obtained from field observation and interviews with the Civil Aeronautics Authority and Tocumen S.A.

o   Logistics Infrastructureinventory: includes 13 free zones, 18 logistics zones, 2 special economic zones already stablished and 10 projects; their total area in hectares and current development level.
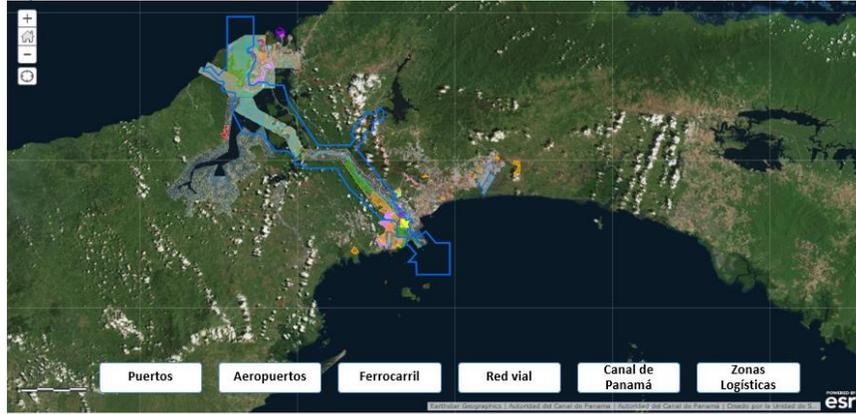

Figure 2. ACP´s GIS containing the ZIC Transportation Infrastructure Inventory

o   Panama Canal: Panama Canal cargo traffic in tons by market segment and the Technology Information Division ESRI inventories and GIS platform. Land Use affairs by interviews with the Corporate Communications Vice-presidency.

- **Current logistic chains mapping and analysis and Potential Chains identification**
  A selection of logistic chains was conducted taking into account the relevance of the total volume and value in the external trade, the actual VALS taking place in the ZIC, a qualitative assessment of the level of employment and wealth generation and the priority development areas for the country. A qualitative BCG[8] Matrix of current segments and VALS in Panama was conducted to select the target logistic chains for analysis. A focus group and several interviews were held to aid in the mapping of each logistic chain and collecting the inputs for the time and cost model for each of them. The mapping and analysis was conducted for perishable products, shoes and clothing, electric and electronics, cars, pharmaceuticals and alcoholic drinks.

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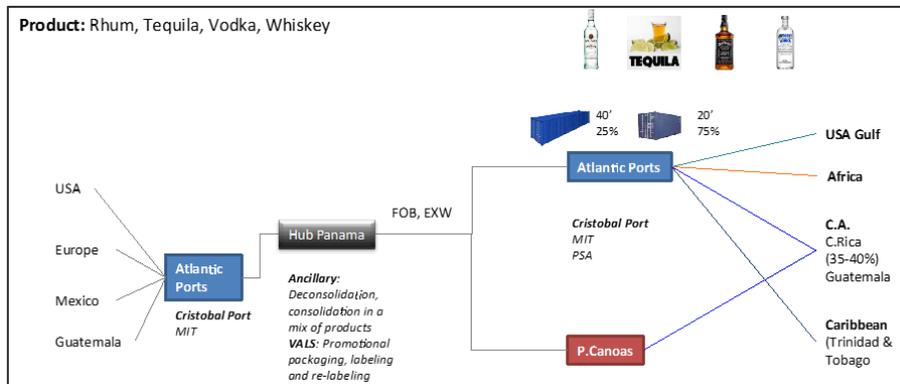
[8] Help a business consider growth opportunities by reviewing its portfolio of products to decide where to invest, to discontinue or develop products. It's also known as the Growth/Share Matrix.

Figure 3. Example of the mapping of current logistic chains for vehicles and APE

From the mapping for the selected chains it was possible to identify most of the aspects hindering the performance of each specific chain, and with the time and cost model it was possible to simulate the potential savings by reducing these inefficiencies.

In the example of the alcoholic drinks imported by sea from Europe, processed in the Colon Free Zone and then exported to the Caribbean an optimized cost and time saving could be up to 36% and 8%, respectively.

For the identification of potential logistics segments a market research study was conducted considering: a) value of the good; b) logistics costs as compared with neighbors and competitors; c) volume and density of value of the good after providing VALS; and d) vertical integration for a given market and possibility to change the structure of the logistics chain. Based on this and by consolidating the segments identified through the analysis of external trade and transshipment patterns, as well as those derived from exogenous factors, a set of 3 logistics segments with 8 logistics families has been identified. The market analysis included interviews with public and private institutions. These provided an understanding of current logistics patterns and Panama's relative attractiveness for these patterns. Interviews included associations of exporters, exporters of perishable goods, investment promotion agencies, institutional logistics operators, and logistics operators (firms).

- **Benchmarking of main international logistic hubs**
  Seven international value added logistics hubs were evaluated. These were Shanghai, Hong Kong, Singapore, Dubai-Jebel Ali, Rotterdam, Philadelphia and Houston. The assessment allowed the identification of exogenous factors as well as strategic capabilities critical to develop a VALS hub: Threshold resources, critical success factors and unique resources.
- **Development of the multimodal transportation and logistics model**
  This fully integrated model includes three main components, described as follows:

  - *Cost and Time Model*. This component captures all the key elements that comprise the relevant logistics cost associated with the transport of each product segment through the study area on the major transportation modes. The analysis focuses on the range of mode and route options that are available to goods flowing between the origins and destinations that are defined as relevant. The model focuses on modeling all-in logistics cost as perceived by decision makers who make route decisions. Critical elements that are included are transportation costs for each mode, the perceived value of time for each product segment, transshipment, handling and storage costs, among others.
  - *Market Demand Model*. This component summarizes the forecast of demand for the major market segments over the period of the analysis. This is based primarily on an assessment of base year demand which is derived from data obtained from each of the modal options. Demand is organized by product segment and zone of origin and destination. For future forecast years, demand matrices are estimated based on establishing causal relationships between base demand and key "drivers" of demand. Potential drivers include mainly macroeconomic growth rates by country as a qualitative assessment of potential cargo flow patterns through the region, IHS projections for containerized imports and exports for LAC were used for the short term unrestricted transshipment forecast. For the long term forecast, GDP was used as a base, utilizing IHS projections for elasticity. A combined analysis was applied in order to evaluate three potential scenarios for cargo flows within the hub.
  - *Demand Assignment Model*. In this final component, the demand is firstly adjusted using market capture scenarios and the allocated among mode options. In the case of the ZIC area, most of the cargo (Re-exports and Transshipment) are originated from and are in destination to outside the ZIC. Market capture factors such as market trends and external competition have been considered to build market capture scenario. In case of internal competition within the ZIC area (which is the case for bi-oceanic transshipment), the assignment has been done using a function of relevant logistics cost of each according to

a logit distribution function. This function estimates the market share of demand captured by each potential mode in the ZIC in relation to other mode. This function is calibrated to reproduce the mode shares observed during the base forecast year, and measure changes in share captured in future years as a function of changes in the relative costs.
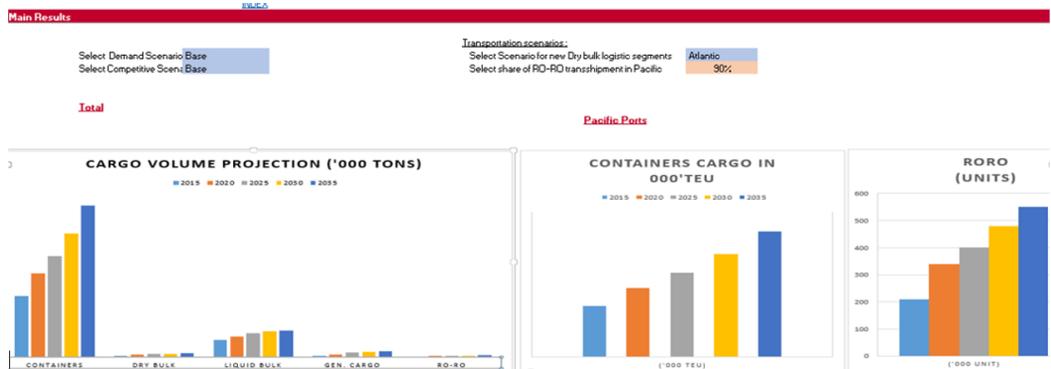

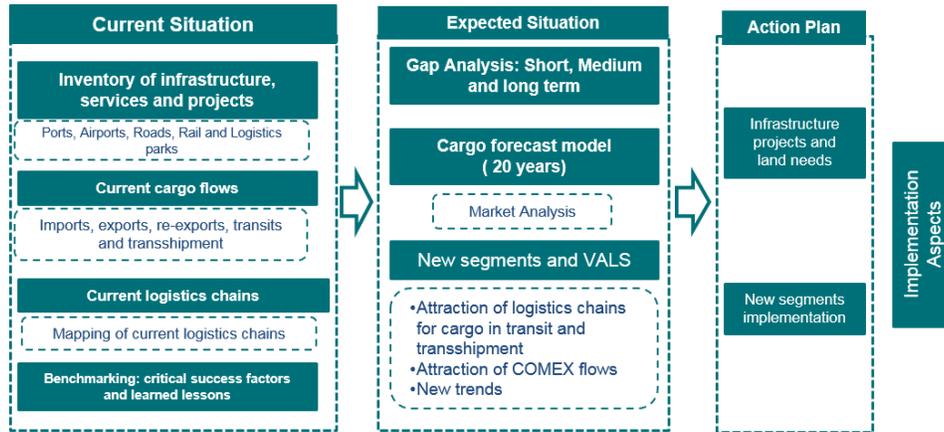**Figure 4. Results tab of the Excel Multimodal Transport Model**

Figure 5. Methodology of the study

During the formulation, the model was continuously validated through workshops, focus groups, direct and indirect interviews and field surveys with stakeholders

Figure 4. Meetings carried out with key stakeholders

3. **FIVE STRATEGIES FOR THE DEVELOPMENT OF THE HUB**

The benchmark of international logistic hubs provided some key findings regarding needs and opportunities for the different market segments that could benefit from operations in Panama. Most of these market segments share critical needs in terms of quality and efficiency of the existing infrastructure, services and control processes. In order to address these needs, five strategies based on international practices have been decided to serve as a guideline for the development of the Panamanian VALS Hub.

Panama can consolidate and expand its current service and market by:

- **Generating a bidirectional Hub-and-spoke system**
  Panama can play a role in the optimization of current logistics patterns for several chains in the Region. Current chains using Panama share a similar pattern. Goods come to Panama for the distribution to the Region. Export concentration patterns were only identified in perishable goods and beverages. Perishables do not receive VALS but only air-air and road-air transshipment. Beverages go to the Region, however a very small volume goes to the US and Africa. The proposal consists of creating a bidirectional hub-and-spoke system by expanding current regional distribution of extra-regional goods with consolidation of intraregional and extra-regional exports.
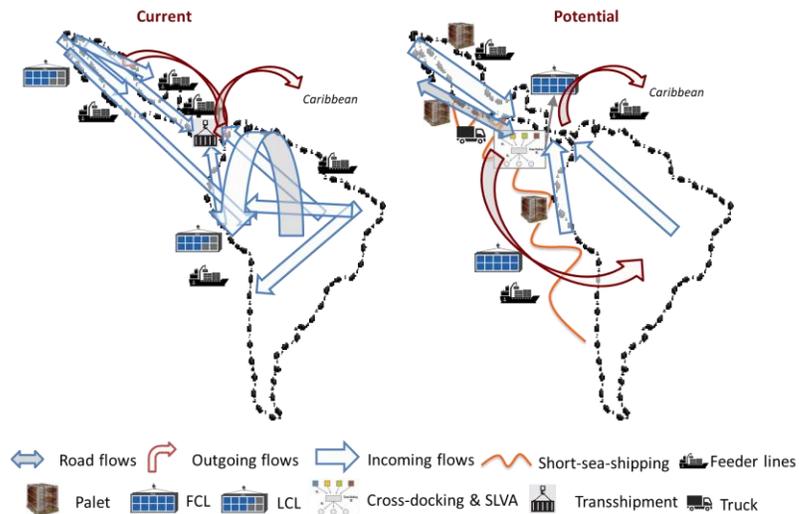

Figure 6. Current and potential flows for Pharmaceuticals, Home Appliances, and Automobiles & Spare Parts

- **Three logistics poles definition**
  Three key logistic poles have been identified in Panama. Consolidating and further developing these poles will generate economies of scale and agglomeration, improve transportation infrastructure investments, homogenize special economic regimes, and allow the integration of processes among the poles, and help coordinate the scheduling of the development program in accordance with the expected demand.

- **Multimodal System**
  A need for an efficient multimodal system with highly efficient fiscal priority corridors with real-time tracking of vehicles in a digital optimization platform has been identified.

In regards to high standard logistics infrastructure, new specialized logistics activity zones for perishables and dry bulks will be required. Tocumen Free Trade Zone and the Panama Canal logistic zone are new core components of the logistics supply and will be important assets in the near future.

An integrated port zone is part of the proposal, and consists of the operational integration of the ports located at the ZIC in order to optimize existing assets. It strengthens Panama's unique resources: its inter-ocean access and the inter-terminal transshipment. A booking system linked to the Panama Logistics and External Trade Platform and its PCS (Port Community System) functionalities, will be an important component.
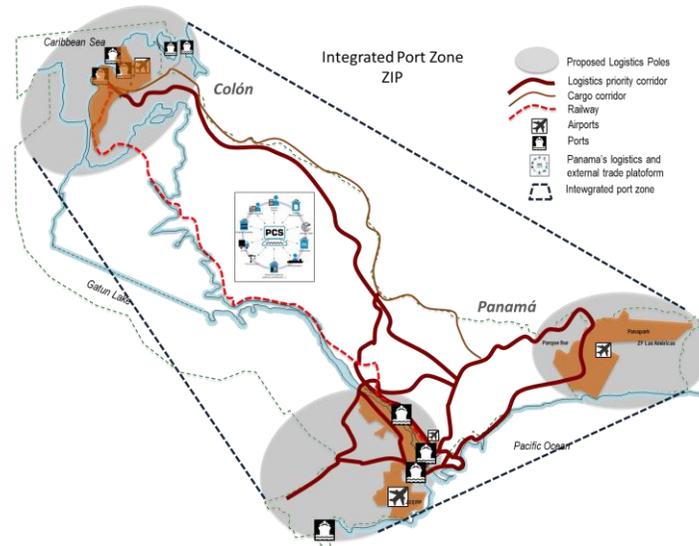

Figure 7. Highly efficient multimodal system proposal and three logistic poles

- **New logistics segments and VALS**

The current Panamanian supply of logistic services is mostly composed of ancillary services – or support services related to transshipment and consolidation flows. These are mostly provided in ports and airports.

VALS are provided to goods in transit entering ZLC, ZEEPP and FTZ and destined to re-exportation. The broadest range of services corresponds to ZLC – also the main contributor to re-exportation flows. However, current VALS are the lowest in terms of value-addition. High-value added logistic services such as assembling and postponement are rather scarce, and reverse logistics, quality control and reconditioning almost inexistent. Pharmaceuticals is the logistics segment that most contributes to value-addition in Panama. In 2015 the average density of incoming goods was 66,000 USD/Ton vs. an outgoing of 107k USD/Ton, a 61% increase; beverages followed with a 24% increase. For the highest-volume segments the change range from 2 to 12%. The proposed strategy is to maintain or improve the current market share of the analyzed existing segments and VALS and generate loyalty by developing new VALS and services.

Three new segments identified as target markets are Perishable goods, B2C (business to consumer segments) and Dry bulks. Logistics chains to be served differ depending on the logistics family.

The perishables segments looks after capturing traditional exports aiming at reaching new extra-regional markets (namely Asian countries) for non-traditional goods usually highly-perishable goods with highly diversified requirements of controlled atmosphere. Some of the VALS offered can include consolidation, cross-docking, cold chain traceability and intermodal services. B2C segments look after deepening the current offer to more value-added VALS and to develop the e-market channel. It ranges from apparel, shoes and textiles to pharmaceutical, medical equipment and vehicles and spare parts, among others. VALS targeted to dry bulks, are mainly proposed to the agriculture related bulks (grains and fertilizers) for packaging, storage, unitization and consolidation and distribution in containers.

- **100% digital hub**
  Logistics optimization will rely on a national Cargo Community System (CCS) that will link all transport and logistics infrastructure. Logistics priority corridors will be also linked to the CCS in order to efficiently implement their fiscal corridor functions. This integration will benefit the private sector by providing them information on real-time flows that can be used to optimize existing assets.

  The AIG (Government Innovation Agency), which leads the technological adaptation on e-government nationwide, along with the Logistics Cabinet, is currently developing the project "Technological Platform of Logistics and External Trade Integration", a platform for logistics processes and operations digital integration.

  It will allow implementing an integrated single window for all administrative procedures and it is expected that the platform will link all stakeholders related to logistics processes in order to optimize the information flow.
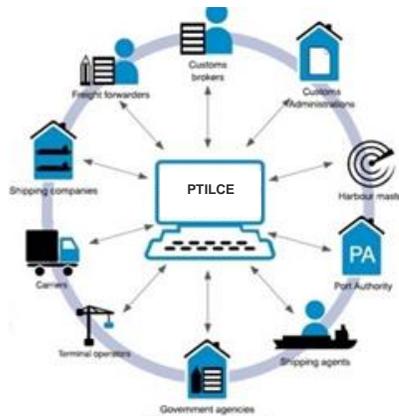

Figure 8. Proposed cargo community platform

4. **SHORT, MEDIUM AND LONG TERM ACTION PLANS**

Short, medium and long-term action plans are proposed for transportation infrastructure, services development, and processes reform based on the five strategies, the long term demand forecast and land availability analysis. The action plans look into overcoming capacity constraints of transportation infrastructure to serve current and future demand by existing and new logistic segments for the next 20 years. It also includes the actions to be taken in order to ensure a gradual, stable and sustainable supply of logistic services, as well as to generate a sound value proposition of VALS to new target segments. It also includes a program for land development (or poles development) according the expected demand phased for up to 20 years and a proposal for reserved areas after 2035. The land use forecast is integrated to the ZICs Multimodal and Transportation Infrastructure Model and calculates the area based on a Ratio (ton/ha) Ratio based on ZLC development Standard.
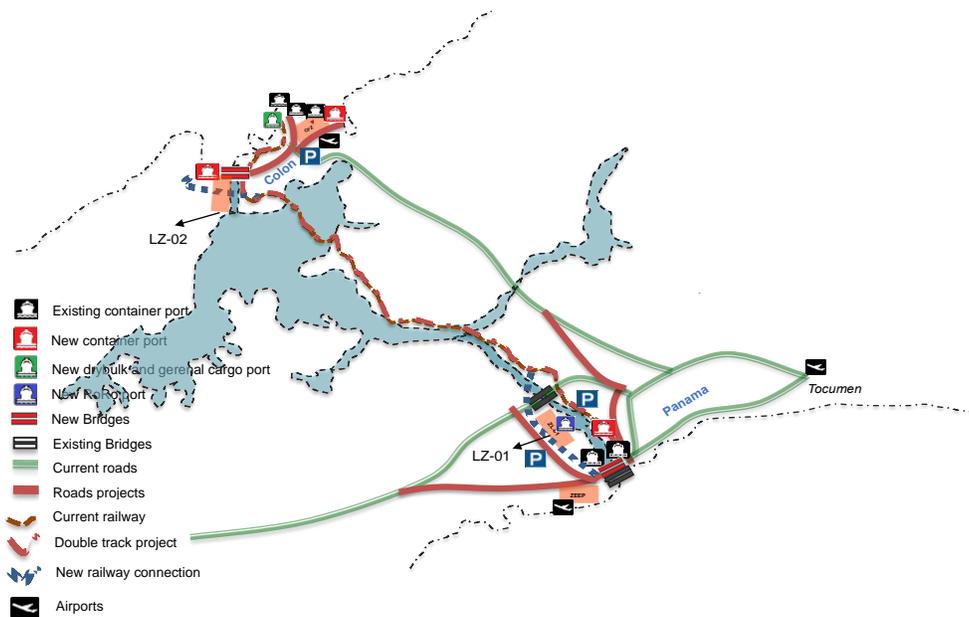

Legend:
- Existing container port
- New container port
- New dry bulk and general cargo port
- New Ro-Ro port
- New Bridges
- Existing Bridges
- Current roads
- Roads projects
- Current railway
- Double track project
- New railway connection
- Airports

Figure 9. Logistics areas development suggested by the Transportation Infrastructure Action Plan

5. **IMPLEMENTATION ASPECTS**

From a case study analysis and best practices that could be applicable to the ZIC, cooperation schemes are proposed at two levels: strategic and operational. The first one is long-term oriented and look after ensuring sustainability and optimizing the execution of the PM-ZIC as a whole, whereas the second points out at beginning the execution of the plan.

- Strategic Level: Institutional, legal and financial components that need to be adjusted in order to streamline the execution of mega-infrastructure projects and effectively launch VALs to new logistics segments. From the institutional perspective, some implemented figures consider a coordination agency focused on financing and capacity building, reinforcing capabilities to capture and assign financing resources on a long-term basis and provide technical assistance to all transversal institutions involved in the execution of the PM-ZIC in all its phases. At the same time, a short-term promoting agency to manage complexities of executing mega-infrastructure projects could speed-up the process.

A legal framework for standardising the different existing regimes within the ZIC (3 poles), and a possibility of creating partial plans in the short term, determining the pole´s borders with its corresponding land management guidelines.

In regards to the financial resources, pre investment funds allocation on a continuous basis and the creation of a solid PPP mechanism that contributes along with public resources and loans.

- Operational level: Developing business plans, creating strategic partnerships, launching a massive training program of HR at all levels, capacity building as well as implementing a regulatory scheme for the ZIP are all actions that should be faced in the short time.

6. CONCLUSIONS

- The need for this master plan was identified in 2015 ´by the Logistics Cabinet´s Infrastructure Committee, which is a part of the Logistics and Competitiveness Secretariat of the Ministry of the Presidency. This committee is currently headed by the Panama Canal Authority and is composed of public institutions and logistics representatives from the private sector. The document was developed jointly with the National Logistics Strategy, led by the Logistics Cabinet.
- This Master Plan is the first integrated transportation infrastructure and cargo logistics planning effort in the country. The study identifies the main challenges for capitalizing on surrounding areas of the Panama Canal and proposes a set of action in infrastructure, services and implementation aspects to offer an efficient platform for value added logistics to contribute to the Canal´s and conglomerate land profitability.
- In May, 2016, the Panama Canal the Authority awarded by public tender a one year contract for the development of the Transportation Infrastructure and Cargo Logistics Master Plan for the Interoceanic Zone of the Panama Canal to the company Louis Berger S.A.S. The study comprised 23 deliverables among workshops, reports, GIS models and a cost and multimodal logistic Excel model.
- Most of the existing market segments share critical needs in terms of quality and efficiency of the existing infrastructure, services and control processes. Based on the benchmarking, the lesson is that Panama could consolidate and expand its current markets by investing in infrastructure and transport services to expand the hinterland. At the same time, generating a bidirectional Hub-and-spoke system, intra and interregional, implementing world-class logistics zones consolidated in three logistic poles to generate economies of scale and mitigate externalities, consolidating a fully intermodal system, with well differentiated short and long distance trips, reducing OPEX by tackling all existing operational constraints, generating high-quality IT infrastructure and implementing a 100% digitalized system.
- Intraregional trade it mostly composed of fast-consuming and industrial goods, in particular in Central America; industrial inputs, food preparations for human and animals, minerals, petroleum, among others. These flows do not usually require VALS rendered in a logistics hub. Durable consumer goods on the other hand, can benefit from VALS in a logistics hub. Panama has a wide experience with durable goods such as clothing, footwear, cosmetics, vehicles and pharmaceuticals, among others; therefore, the challenge is in expanding to a new segments and diversifying the nature of VALS for these intraregional flows.
- The development of a VALS Hub is a national priority aimed at promoting the exportation of services, value capture, and therefore maximizing the opportunities for employment generation.
- The PM-ZIC is a complex endeavor that implies public and private investments in a relatively short period, thus demanding that the whole set of public and private resources be available accordingly in an optimal manner.
- The execution of the plan requires an active involvement of public and private institutions to finance, promote, and execute its diverse components at strategic and operational levels.

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