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A PROPOSAL FOR ANALYSIS OF LOGISTICAL RESTRICTIONS AND OPPORTUNITIES IN AN EASTERN AFRICAN PORT: NOTES FROM A TECHNICAL MISSION

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ABSTRACT

As Gonçalves (2007) has pointed out, over the course of the 20th century logistics grew from having a fragmented and diluted profile within organizations to playing a key role in the strategy of the networks and chains of international business. In the 21st century, as will be shown in this article, logistics will expand these functions to include social and political roles in international relations. The installation of a port in East Africa on the Red Sea is the critical incident examined during a technical mission undertaken by a researcher in 2009. In the shape of a checklist, this survey pointed out major barriers in infrastructure, information, rules, and norms. Results indicated crucial constraints in infrastructure and institutional opportunities, which have an impact on the implementation of new developments there. The gradual development of the organizational arrangement of a complex undertaking such as building a port can play a key role in alleviating the underdevelopment of African countries.

Key-words: Logistics. Ports. Supply Chain. Global Operations. Africa.

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PROPOSTA DE ANÁLISE DAS RESTRIÇÕES E DAS OPORTUNIDADES LOGÍSTICAS EM PORTO LOCALIZADO NO LESTE DA ÁFRICA: NOTAS DE MISSÃO TÉCNICA

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RESUMO

A logística passou ao longo do século XX, como lembra Gonçalves (2007), de um perfil fragmentado e diluído no interior e no valor das organizações, para um papel crítico na estratégia das redes e cadeias de negócios internacionais. Para o século XXI, como será observada nesse artigo, a logística extrapola essas funções passando a representar um papel político e social nas relações internacionais entre países. A instalação de um porto localizado no leste africano, próximo ao Mar Vermelho, será o incidente crítico analisado durante uma missão técnica empreendida por um dos pesquisadores no ano de 2009. Essa pesquisa de campo, sob a forma de diário de bordo, apontará as principais barreiras no âmbito das infra-estruturas, das informações, das regras e dos princípios culturais. Os resultados indicam restrições críticas de infra-estrutura e oportunidades institucionais que impactam na implantação de empreendimentos naquele local. Será demonstrado que o desenvolvimento progressivo do arranjo organizacional de um empreendimento complexo, como o portuário, pode ser papel chave na inversão da condição de miséria e de pobreza nos países africanos.

Palavras-chave: Logística. Portos. Cadeia de Suprimentos. Operações Globais. África.

1 INTRODUCTION

The length of the activity cycle accounts for the main difference between national and globalized operations, the latter reaching cycles often measured in weeks or months. Besides being less consistent and less flexible than logistical operations within a country, globalized operations increase the difficulty of logistical planning, resulting in the need for larger stocks (Bowersox and Closs, 2001, p. 148). Over time, ports have not accompanied the gains in scale in the oceanic transportation industry and the improvements in the infrastructure of land transportation networks (paved roads, tunnels, bridges etc.). In developing or third-world countries, as is the case with the subject of this article, the construction of port installations and facilities has to cope with the lack of basic infrastructure. This situation was deeply analyzed by Voordijk (1999) in his analysis of operational and manufacturing logistical bottlenecks in Eritrea, showing that behind infrastructure restrictions, challenges exist due to legal barriers, and a lack of education, cooperation, and political will.

Ports are one of the paths leading to the integration of a country or region with the rest of the world, and a new modality of port operation—regardless of how simple the installation—is a complex organizational network. This complexity reaches such scope that it interferes with the environment within which it is inserted, whether at the micro- or macro- level. The expectation created by such a large venture, in a region lacking infrastructure (as do most nations in the Horn of Africa), becomes a catalyzer of local social and political bottlenecks. A port is, above all, a dynamic system. Gonçalves (1990) emphasizes that these complex organizations can be understood as having four roles: institutional, relational, processual, and operational.

> It is not hard to understand why [each one of these] four basic roles are necessary—but not sufficient—conditions for the emergence of an organizational network. Whereas the role relative to the institutional level supplies identity and legitimacy to the existence of the network, that referring to the relational level seeks to ensure the articulation and solution of conflicts between the interests of the various component organizations. The role referring to the processual level pursues the compatibilization of the operational procedures and norms, and finally the role at the operational level offers the infrastructure required for the production of utilities. An organization may also be sustained by only one of the four roles, which would compensate for the other links (Gonçalves, 2007, p. 55).

Could a modern port facility built in a poor country be anchored, even initially, by one of these roles, thus generating a compensatory trade-off sufficient to leverage a region's development in the near future? If the answer is positive, it implies that even by betting on just one role or link, a poor country or region would see an apparently paradoxical economic inversion. If the answer is negative, investments in port infrastructure (operational role) would not be by themselves sufficient or even safe for local development. Would the trade-off of the four roles assist in the evolution of the generation of ports?

This scenario, divided into four stages, will serve as analogy and backdrop for the investigation of the questions discussed in the text. If the agents in charge of establishing the port being studied can adequately articulate such roles, they will be able to establish a minimum level of operational excellence, even under adverse conditions.

1.2 THE RESEARCH PROBLEM AND OBJECTIVES

The introduction of port infrastructure has been seen as an opportunity for social and economic development in many countries in Eastern Africa and the Middle East. However, given the prevailing political and economic context in these countries, various restrictions can limit a port project. Building new ports, particularly in less economically-developed areas, entails overcoming environmental restrictions and a lack of logistical support infrastructure and adequate road and rail access corridors, which hinder new investment initiatives (Fossey, 2001). Moreover, these countries, hitherto overlooked by Westerners, have become a feasible alternative for the production of food and renewable fuel, such as ethanol.

In light of these opportunities and restrictions, the main objectives of this research are:

- ✓ Analyze, under a methodological scheme, the restrictions and opportunities for establishing a port facility in Eastern Africa;
- ✓ Build an instrument for data collection to guide the activities in the area, considering the difficulties in obtaining data in a country situated in a little-known region;

- ✓ Discuss the roles of institutional agents, in a given organizational arrangement, vis-à-vis the challenge of establishing and sustaining a modern port terminal under adverse infrastructural conditions.

2 THE ROLE OF PORTS IN GLOBAL SUPPLY CHAINS

The major functions of a port—besides serving as an interface between road and maritime transportation and carrying out embarkation and disembarkation functions—include the supply of complementary services such as customs dispatches, storage, processing (handling of materials), packaging, and distribution (United Nation, 1999, p. 8).

The evolution of ocean-going vessel construction has made ships faster, more modern, and safer, thereby requiring that the infrastructure for storage, embarkation, and disembarkation at ports follows suit. As a response to this evolutionary process in shipbuilding, Nicoletti (2006, p.165-168), in a survey conducted at the Brazilian port of Santos, previously noted the search for increased productivity and the trend towards the modernization and improvement of the reception and embarkment systems in the terminals.

Inefficient port terminals are not attractive to shipping companies unless they are motivated by compensation for meeting this demand.

Ports and other intermodal points of interface represent important restrictions to the expected performance of global logistic operations. A large economy in maritime transportation can be reduced or even nullified by operational deficiencies in the loading and unloading of vessels in a certain port. According to a report from the World Bank (2001b), this phenomenon started to become a world trend in the 1980s, contributing to the gradual degradation of service quality in the international chain of physical distribution.

As a general trend for the 21st century, companies will continue to expand their operations globally so as to increase the logistical scope of their sources of supply and their physical distribution. The limits to this expansion are ultimately determined by the total cost of delivering goods, which in turn relies heavily on the logistical costs of acquisition of primary and intermediate inputs, and the costs of delivering finished products to the market (World Bank, 2001a, p. 20).

According to the United Nations (1999, p.7), decisions concerning the sources of raw material, transportation systems, delivery time, and distribution channels are increasingly being made on a global basis. Gradually, ports are being considered as integral parts of global logistical chains, incorporating an array of other services in addition to the traditional ones, called value-added services, so as to form integrated port communities, known as second- or third-generation ports. Large ports such as Rotterdam (Holland), Yokohama (Japan), Antwerp (Belgium), Hamburg (Germany), Marseille (France) and Houston (USA) offer attractive locations for the establishment of industrial firms or physical product distribution businesses (World Bank, 2001).

Ports are being obliged to move above and beyond their old role as merely a link between the matrices of national and international transportation. The diversification of the services offered by ports, outside their traditional ambit of piers and warehouses, requires the structuring of a port community with closer links to the city and its users, so as to transform it into a platform for trade logistics (UNCTAD, cited by BNDES, 1998).

Shifting from the traditional role to the new involves changes that will turn a given port into a first, second, or third generation facility, according to definitions provided in Table 1.

PORT CLASSIFICATION	FUNCTIONS PERFORMED	LEVEL OF ORGANIZATIONAL ARRANGEMENT
First Generation	Maritime access, transfer of goods, storage, and delivery to the vessel.	**Operational**
Second Generation	First generation activities plus: - Industrial and commercial activities - Center for port services	**v** **v** **v**
Third Generation	Second generation activities plus: - Structuring of port community - Stronger port-city-user connections - Services outside the port - Structure of information systems - Logistics center	**v** **v** **v** **v** **v** **v**
Fourth Generation	Third generation activities plus: - Modal integration (Road-rail-air) - Industrial processing zones - Port-industrial clusters - Business networks - Residential, Leisure, and tourism centers.	**v** **v** **v** **v** **v** **Institutional**

Table 1: Typology for the classification of ports proposed by UNCTAD, according to the scope of the functions performed and the institutional arrangement of interdependence.

Source: Adapted by the authors from BNDES (1998, p. 2-3).

Table 1 departs from the premise that the level of complexity of a port is directly proportional to the level of the organizational arrangement. Most ports are first or second generation facilities. Larger ports usually offer attractive locations for the establishment of industries and distribution firms. Recent years have witnessed the development of industrial hubs in the ports of Rotterdam, Yokohama, Antwerp, Hamburg, Marseille, and Houston (World Bank, 2001b, p. 7), as well as in the area of influence of the Port Authority of Valencia, Spain and the Free Trade Zone of the Chinese port of Tianjin (Gonçalves, 2007), typical structures of fourth generation ports.

The shift from second to third generation is a process involving a higher degree of change, with the presence of technological, organizational, political, and cultural factors, so that the consequence of the port's transformation is a community of logistical, industrial, and support services, as well as information systems, all integrated with the city and perfectly attuned with the local commercial environment. The fourth generation involves the port framework within business networks and more complex organizational forms. A compilation of the principal aspects of these features can be found in a study conducted by Dutra, Zaccarelli, and Santos (2008).

Exemplifying this array of services, the World Bank (2001a, p. 27) presents a general view of port services with aggregated value, seen in Figure 1. Basically, aggregated-value services are divided into logistical and support services (or "facilities"). Logistical services are in turn divided into general services and those that integrate the logistical chain.

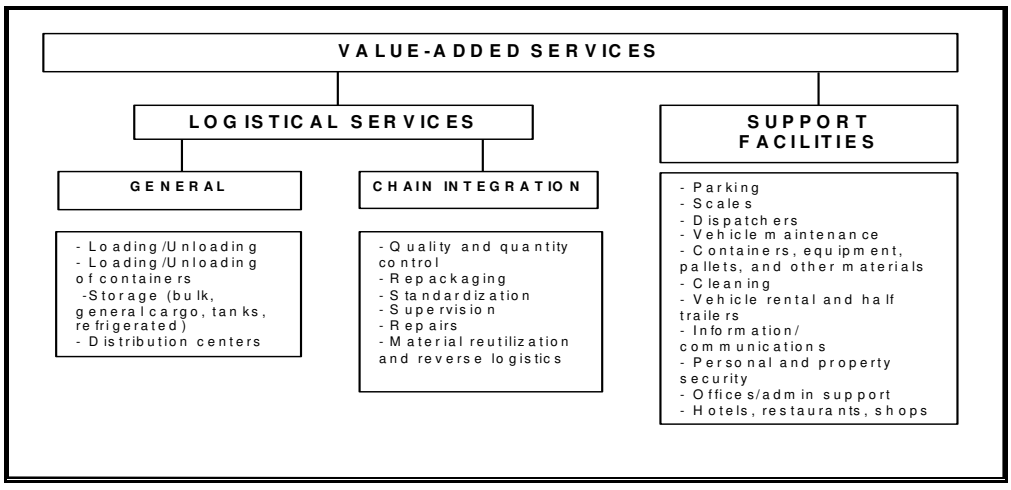

Figure 1: Overview of value-added services at ports.

Source: Adapted by the authors from World Bank (2001b, p. 27).

Figure 1 shows how complex and dynamic a port's logistical operation is. This complexity increases when one imagines a port integrated into a community. Around it, depending on governmental, cultural, social, and political factors, entire cities develop and begin to operate, even if informally, in service of this enterprise. This gives the port a differentiated character, that of a complex, socio-technical organization. Next, brief accounts of the region's political and economic context will be presented, which are determinant to the analysis of the establishment of the port project which constitutes the subject of this research.

3 THE REGION'S POLITICAL AND ECONOMIC CONTEXT

According to Voordijk (1999) and Sanderberg (2005), two of the rare studies analyzing the logistical and manufacturing restrictions in Eritrea, countries in the Horn of Africa—Sudan, Djibouti, Eritrea, Ethiopia, and Somalia—have faced years of cultural, political, and religious civil wars, negating their strategic location adjacent to the Red Sea and weakening any local development actions. Nevertheless, according to Voordijk, restrictions already existed through a lack of basic infrastructure such as the regular supply of utilities, sanitation, and port access corridors. It is estimated that 70% of roads are unpaved, hindering the internal movement of products and services, and only 20% of the vehicle fleet meets minimal maintenance conditions. These infrastructure barriers are heightened by difficulties imposed by the political structure.

Islamic-oriented military regimes, civil wars, and policies of social and economic segregation of minorities exist in various nations in the region. Bureaucratic, legal, and governmental barriers, allied to constant civil wars (mainly after decolonization), mean that these countries lack international trust for conducting business, preventing the advance of inter- and intra-regional trade. Adding to this negative perspective, Voordijk (1999) adds that illiteracy, nearing 90% in the region, will—if not addressed—perpetuate absolute poverty in these nations, regardless of the technological effort made there.

Figure 2: Map of the Horn of Africa and Middle Eastern regions

Source: www.economiabr.defesabr.com

To break the cycle of chronic poverty, Voordijk (1999) points precisely to the inversion of the logistical super- and infrastructural restrictors as key to a transformation, albeit a slow one, of the entire sub-Saharan region. The next items will demonstrate, through travel notes structured as a checklist, the challenges to the establishment of a port (a crucial element in the logistical operations of countries).

4 RESEARCH METHODOLOGY

The investigative process entails the existence of a certain methodological awareness and division of labor so as to reach the desired objective (Kaplan, 1975, p. 26). Thus, for a technical mission to be well-structured, it is necessary to create a data collection tool tailored to the main aspects to be addressed in this research: infrastructures, information, rules, and cultural principles. The bibliographic review was the basis of the questionnaire for the field survey.

Cooper and Schindler (2003) suggested that an exploratory study should normally begin with the search for published data, continuing with the search for individuals who are well informed about the issue. Data from the International Monetary Fund and the World Bank, in addition to research on the Internet, enabled a first, albeit superficial, investigation of the environment to be explored. The literature review on the subject of the research, according to Yin (2001), does not aim to obtain answers, but to devise a way to prepare for the development of more objective and perspicacious questions about the issue.

This work will apply the single case study method (Yin, 2005) to a port in Eastern Africa, using data collection and technical annotations from the 2009 mission of a specialist in port and logistical projects. The instrument of collection (of the notes or of the "ship's log") was previously planned and the results were analyzed under a methodological framework. It is worth pointing out that a technical mission does not always manage to capture all of the local subtleties. As already emphasized here, these countries have been undergoing, since the 1960s, a series of deep political crises and wars, fed by religious and cultural disputes. Therefore, some information amassed in the collection instrument, of a confidential nature, can be omitted.

4.1 THEORETICAL SCHEME

In analyzing a logistical operation as complex as a port, it is impossible not to discuss or reflect upon technological and non-technological inter-relationships. The technological ones concern the first two levels in Figure 4. As one progresses to the higher levels, the focus shifts to cultural, political, and

socioeconomic questions. The complexity of the analysis increases and the function of a port, merely technical in its role as facilitator of the international flow of goods, becomes a social function, with the possibility of promoting the formation of local productive clusters, formal or informal, in its surrounding area. This formation of agglomerations of firms can create, according to Amato Neto (2000), a dynamic cooperation in the search for collective solutions.

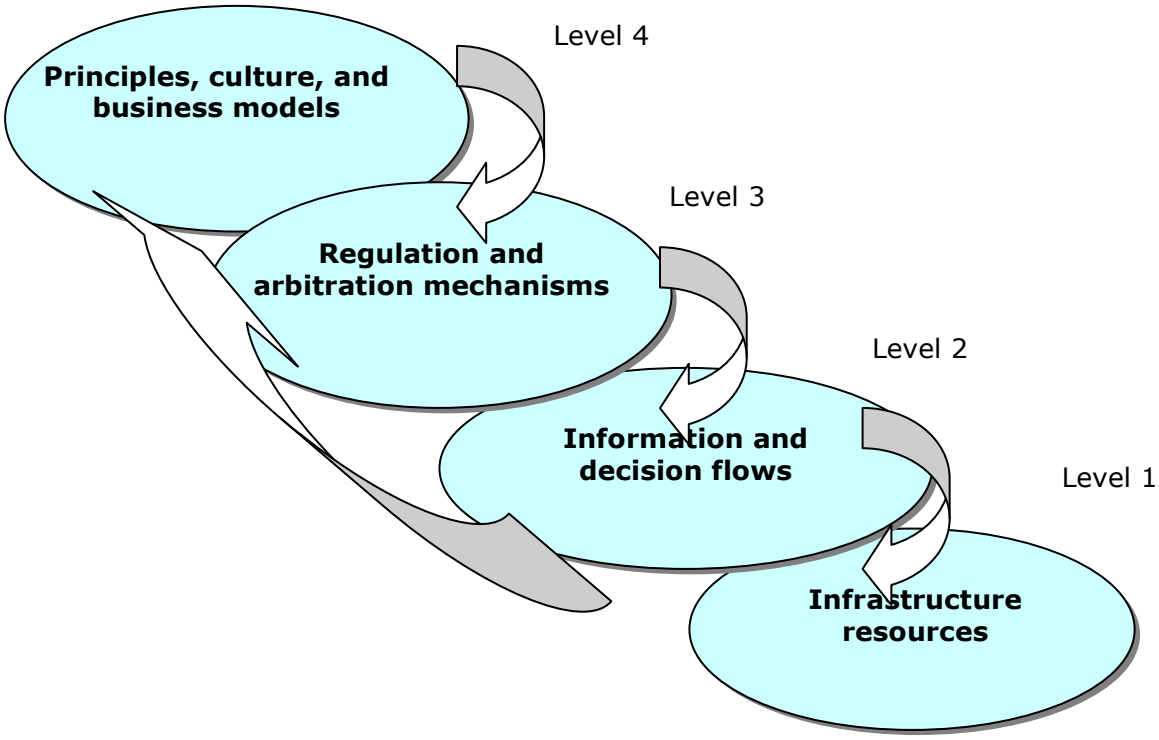

Figure 3: Levels of processes involved in the logistics of international operations.

Source: adapted by the authors from Gonçalves (2007)

The concept of the four levels in Figure 3 can be better understood if the contents and logistical elements are explained. An adaptation was made to the model created by Gonçalves regarding the communication between the levels. They self-supply themselves to the extent that they supply or deny inputs such as controls, information, and resources required for their support. For instance, a law can facilitate the arbitrage or even the flow of information of an arrangement insofar as it establishes transparent legal procedures or parameters for the entities involved. Table 2 presents the opening of the four levels according to the criteria adopted by Gonçalves (2007).

LEVELS OF PROCESSES INVOLVED IN THE LOGISTICS OF INTERNATIONAL OPERATIONS			
LEVELS	**CONCEPT**	**CONTENT**	**LOGISTICAL ELEMENTS**
Level 4	Principles, culture, and business models.	Universally-accepted models of business and of regulation	Logistics providers and operators
			Financial and support bodies
			International and national regulatory agencies
			Arbitrage and control
Level 3	Regulation and arbitration mechanisms	Contracts, agreements and rules of national and international operation and regulation.	Types of contracts for supply and models (protocols) of partnerships and cooperation
Level 2	Information and decision flows	Logic of operational flows	Telecommunications
			Information and integrated management systems
			Applications of information technology
Level 1	Infrastructure resources	Value aggregation through distribution	Ports (dry and wet)
			Airports, industry
			Distribution centers
			Transportation modes (including pipelines)
			Equipment handling
			Systems for storage of materials and cargo consolidation

Table 2: Levels of processes involved in the logistics of international operations.

Source: Gonçalves (2007)

A very similar methodological scheme was used by Voordijk (1999) in his analysis of logistical operations in Eritrea. The author divided it into basic infrastructure (transportation and telecommunications systems), environmental enablers (government, industrial policy, and educational system) and level of firms (raw material, manufacturing capacity, and distribution and exports).

4.2 CHECKLIST PREPARATION AND DATA COLLECTION RESULTS DURING TECHNICAL MISSION

The preparation of a checklist, based on Gonçalves (2007), had as objective the structuring and grouping of that which should be observed during the 10-day technical mission to the region of the port terminal. The following tables illustrate the main results of the field survey relevant to the theme of the current article.

LEVEL 4—PRINCIPLES, CULTURE, AND BUSINESS MODEL Content: universally-accepted business and regulation models	
Logistical providers and operators	
Own or outsourced labor?	Own
Own or outsourced transportation?	Outsourced—firms hired by exporter
Logistical providers?	No. Only basic transportation services
Financing and supporting bodies	
Investors / Partners	Local government, Kuwait Investment Fund, Saudi Arabian government, and others
National and International Regulatory Agencies	
Labor security norms	Use of protection equipment (helmet, gloves, goggles etc.) not observed
Protection and firefighting norms	Have own rules
Have ISO certification? Which?	No
Norms for electrical installations	British Standard
ISPS Code?	Yes, the port is adapting to International Safety Norms For Ships and Port Facilities (ISPS)
Arbitrage and Control	
Commercial practices	Member of Int'l. Sugar Organization (London)
Economic information	
Local currency	Sudanese Pound (SDP)
Conversion to dollar	1 US$ = 2.23 SDP
Environmental issues/restrictions	The firm has a policy for reducing emissions and supports reforestation

Table 3: Results Obtained for Level 4—Principles, Culture, and Business Model.

Source: data collection

LEVEL 3—REGULATION AND ARBITRAGE MECHANISMS Contracts, agreements, and operation and regulation rules	
Types of supply contracts	
Contracts based on international practices?	Yes, on the Int'l. Chamber of Trade. They comply with INCOTERMS (International Commercial Terms)
Partnership and cooperation models	
Technological Cooperation	Yes
Partnership model	Technical missions and int'l. exchange

Table 4: Results Obtained for Level 3—Arbitrage and Regulation Mechanisms.

Source: data collection

LEVEL 2—INFORMATION AND DECISION FLOWS Logic of operational flows	
Telecommunications	
Telephony	Yes
Radiocommunications	Yes
Internet	Precarious, with constant breaks in information flow
Information and Integrated Management System	
Scope	Local Network
Integrated management system	Yes
Information Technology Applications	
Type of collection/data reading (barcode, written manual, typed manual, RFID, etc.)	Currently manual.
Data storage	Part stored electronically, part stored as physical documents
Electronic data interchange (EDI)	Currently none

Table 5: Results Obtained for Level 2—Information and Decision Flows.

Source: data collection

LEVEL 1—INFRASTRUCTURAL RESOURCES Value aggregation through distribution	
Port analyzed	
Characterístics	Multifunctional port, managed by state-owned firm
Extant terminals	Containers, oil, bulk cargo, grain, vehicles etc.
Predominant configuration	Traditional pier
Airports	
Neighboring airports	The port city has an airport
Air cargo terminals	Yes, annexed to the airport
Distribution Centers	
Availability of distribution centers	None. Users build own facilites
Road Transportation	
Road type/paving	Single lane, paved
Road conditions	Bad
Typical truck—features	Tractor with two semi-trailers, resulting in extra-long composition (some 30m)
Typical truck—cargo capacity	50 tons
Rail transportation	
Railway access to port?	Yes, partial
Railway gauge	Narrow
Electrified network ?	No
Typical or most common carriage	Closed. Specialized hoppers for open-top sugar or grain loads are rare—most are adapted
Max. cargo capacity per carriage	50 tons

Table 6: Results obtained for Level 1—infrastructural resources.

Source: data collection

Geographical information	
Distance from port to city	**Annex of the city**
Climate features	**Desert. Temperatures between 35ºC and 45ºC. Few clouds in February and March. Humid air due to proximity to the sea.**
Soil characteristics	**Sandy, dry**
Seismic area?	**No**
Access channel to port: features and depth	**Wide, unobstructed, 15 to 16 meters deep**
Tide variation	**0.8 m to 2.0 m**
Interferences (drainage, electrical)?	**No, the area is clean**
Wind speed	**Presence of strong winds up to 130 km/h reported—recent history**
Dust	**Accounts of sand storms relatively frequent**

Table 7: Geographic Information.

Source: data collection

Water and Power infrastructure	
Location of power substation in relation to the area of project	**5 km**
Power supply reliability	**Low. Frequent power outages (at least twice a day) and prolonged interruptions (30 mins. to two days)**
Power generation	**Need to install autonomous thermo-electrical generator, capable of meeting the power demand of the facility for up to two continual days of**
Typical voltage of electrical industrial equipment (pumps,	**433 V**
Power frequency	**50 Hz**
Norms for equipment and electrical components	**British Standard**
Reliability of drinking water supply	**Low. Constant lack of water and prolonged interruption periods (several days to weeks without**
Water supply	**Anticipate water supply by trucks, large reservoirs, and water towers for internal distribution of water to buildings .**

Table 8: Water and Power Infrastructure.

Source: data collection

Need for Utilities	
Steam generation	Yes
Power generation	Yes
Internal power distribution network	Yes
Internal drinking water distribution network	Yes
Compressed air generation	Yes
Treatment of effluents	Yes
Hydraulic pressure generation	Yes
Internal collection and transportation of garbage	Yes
Dust aspiration, capture, and filtering systems	Yes

Table 9: Need for Utilities

Source: data collection

The availability of logistical products and services is influenced in a determinant manner by the geography, the natural environment, and the sociopolitical organization of the territory, according to Kobayashi (2000). As observed by the World Bank (2009), after over two decades of war the infrastructure of the country under discussion requires serious rehabilitation and development, agricultural reforms, and improvements in social services. As the research results confirmed, the analyzed region lacks basic infrastructure, but depending on how they are approached the logistical restrictions present can become an opportunity for business development and for the region's social and economic development.

5 CONCLUSION

This research had a paradoxical outcome: when the technical mission began, relevant technical barriers and hindrances were envisioned. That assumption was evidenced by the results of the qualitative checklist used. In other words, the available infrastructure apparently does not offer efficient conditions for the regular operation of a port system in the region visited. Limitations begin with the lack of basic requirements, such as utilities, to include more encompassing ones, due to the fragile and unstable conditions of local governments. The final conclusion could be simple and direct, but if analyzed from the social perspective, one can reach a different conclusion: that of the formation of links, albeit tenuous, strengthening the weaker areas, a situation which ratifies the original proposition, namely that when one or more levels of the organizational arrangement are suppressed, all others seek to compensate. The efforts of local governments and international agencies (Institutional level), obviously anchored by economic interests, could overcome the region's technical deficiencies, generating conditions for social development and positioning the port as a center for the convergence of new investments (industrial, commercial, tourist, etc.). Within this context, a port system becomes a social investment,.

This demonstrates that analyzing a venture from only the technical angle does not suffice, even if the mission was of a technical nature; it must also be viewed from a social perspective. Other relevant questions emerging for future research are: is the foreign technology to be used appropriate for the local conditions? What are the local competencies?

As a limitation to the study, one realizes that some links and causalities are implicit in the organizational arrangement and are not visible using checklists. The analysis would need to "climb," starting at the Operational Level and seeking to reach the Institutional Level. To that end, in a next step, the data collected in the checklist could be quantified and new agents could investigate, creating parameters for future analysis. However, as an exploratory study, the scheme presented in the form of a list can assist managers in the examination of relevant points in the establishment of a port infrastructure.

The analyzed port intends to invest in infrastructure at an operational level in order to increase its first generation characteristics (see Table 1). Nevertheless, the more fragile the intermediate levels, the lower the possibility of the port transitioning to the second, third, or fourth generation. The research pointed out that the basic needs of Level 1—infrastructural resources—have not been minimally met. Despite that, should a link be woven, however weak, between the organizational levels of interdependencies, such a venture can gradually succeed insofar as it leverages the other links, strengthening the entire arrangement.

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