01-051 – Ensuring the resilience of port activities against disruptive events: the case of the Port of Valencia – Asegurando la resiliencia de las actividades portuarias frente a eventos disruptivos: el caso del Puerto de Valencia.

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English English

The objective of this study is to systematically address resilience in port environments and its contribution to securing global supply chains against disruptive events, identifying best practices and a roadmap for future applications. To achieve this, different possible approaches have been evaluated based on a review of the state of the art. From this review, the application of business continuity methodologies has been identified, specifically following the standard proposed in ISO 22301, which has been adapted to the port sector for this purpose. This methodology has been applied to the Port of Valencia, one of Europe's leading ports in terms of traffic. Its application has made it possible to identify the benefits it provides, as well as the limitations that arise and the future fields of study that emerge from it. Among the key conclusions, stand out the importance of defining the concept of port business continuity, the scope of the model and its interactions within the framework of a complex system, such as the port sector—where a wide variety of stakeholders operate in a shared space—, as well as the relationship between the port system and the resilience of the supply chain in which it is embedded.

Keywords: *Resilience; Ports; Supply chains; Business continuity*

El objetivo ha sido abordar sistemáticamente la resiliencia en ambientes portuarios y su contribución al aseguramiento de las cadenas logísticas globales frente a fenómenos disruptivos, identificando mejores prácticas y una hoja de ruta para futuras aplicaciones. Para ello, se han evaluado las diferentes aproximaciones posibles basándose en una revisión del estado de la cuestión. De esta revisión se ha determinado la aplicación de metodologías de continuidad de negocio, en concreto conforme al estándar propuesto en la ISO 22301, que se ha adaptado al caso portuario para este fin. Esta metodología se ha aplicado al Puerto de Valencia, uno de los puertos líderes en tráfico a nivel europeo. Esta aplicación ha permitido identificar los beneficios que proporciona, así como las limitaciones que surgen, y los futuros campos de estudio que esto genera. Entre las conclusiones destacan la importancia de fijar la definición del concepto de continuidad de negocio portuario, el alcance del modelo y sus interacciones en el marco de un sistema complejo, como lo es el portuario, en el que una amplia variedad de agentes actúa en un espacio común, así como la relación del sistema portuario con la resiliencia de la cadena logística en la que se enmarca

Palabras claves: *Resiliencia; Puertos; Cadenas logísticas; Continuidad de negocio*

1. Introduction

In a highly globalized world, the proper functioning of logistics is key to the proper supply and distribution of goods that guarantee the well-being of society and economic growth. In recent years we have witnessed different disruptive events that have tested the resilience of these global supply chains, highlighting their relevance and the need to adequately prepare for these events and, more importantly, for their effects.

Ports are key players in these supply chains. 90% of world trade circulates through them, including raw materials, intermediate goods and final products. Ensuring the operation of port systems is therefore an unavoidable element if we want to guarantee the security of global supply and distribution chain.

In the past, ports have worked in stable environments that allowed them to anticipate these potential disruptive events and adapt to the changes they entailed. Currently, the complexity of the chains, which are increasingly stressed, together with an increase in the volatility of the events that are recorded(Notteboom et al., 2024), as well as the trends in the port sector itself, with greater degrees of automation and digitalization, have made the management of port resilience a complex process.

In this framework, the adoption of so-called business continuity approaches, such as those proposed within the framework of the ISO 22301 Business Continuity Management System, is revealed as a powerful tool that can help port managers address the problem and facilitate compliance with the new global requirements in this area.

The example of the application of this type of system to one of the main European ports, such as the Port of Valencia, managed by the Port Authority of Valencia, gives us the keys to the success of this implementation, as well as its limitations and the future steps necessary to integrate them with the initiatives carried out in the rest of the supply chain.

2. Objectives

The main objective of the study was to validate the use of Port Business Continuity Management Systems (PBCMS) as the best option to ensure a proper response to disruptive events within the port industry.

This main objective was developed in some specific objectives related to:

- Analize the role of ports in the supply chain resilience and the
- Understand the basics of Business Continuity Management Systems for Ports (BCMS)
- Propose a framework for applying BCMS to the port sector
- Check the framework towards a real case, using the Port of Valencia as a testing bed

3. Methodology

In order to cover the proposed objectives a first step was to understand the role of ports within the supply chain and thus identify the relevance of port resiliency to ensure the resilience of the whole chain. Then a clear definition of what is understood as port resiliency was required. After that, a first analysis of the different management tools available to ensure that resiliency was required, identifying the pros and cons of these tools.

Once the Business Continuity Management Systems was selected as the most appropriate tool, we develop a roadmap towards its implementation that we finally applied to one of the most relevant ports in Europe: the Port of Valencia.

3.1 Analyzing the resilience of global supply chains: the role of ports

The International Monetary Fund defines Globalisation as "the rising economic interdependence of countries during increasing volume and multiplicity of cross border transactions in goods and services, freer international capital flows, and additional speedy and common diffusion of technology" (*Globalization: Threat or Opportunity? An IMF Issues Brief*, n.d.). Globalisation was based in the search of global efficiency for the production of goods, where different countries and regions offer the most suitable mix between the different production factors to provide a final product or service, to be distributed to the final consumer also with a global approach (Orlanyuk-Malitskaya et al., 2024).

Thus, Globalisation has resulted in more sophisticated global supply chains, where producer and consumer, not only of raw or final products, but of intermediate goods, often are in different continents and relay in these logistics to ensure this flow of goods keeps flowing. As logistics consists, mainly, in the balance of transport and stock, the efficiency of the supply chain is measured and how this transport and stock are managed and balanced along the chain. Driven by the stock reduction to reduce global logistics cost, the application of principles like just-in-time has even put more pressure in the supply chains (Ye et al., 2022), imposing more stress to the transport element and requiring more coordinated and lean logistics processes in a more tense balance. We can conclude, then, that transportation has become a key element and enabler of Globalisation (Kherbash & Mocan, 2015)

In recent years, we all have understood the importance of a proper functioning of supply chains as enablers of productivity and competitiveness for the economy and for ensuring the wellbeing of societies. Supply chains facilitate access to product and services needed for a broad range of supplies, from food to pharmaceutical and health products for the population and inputs for that are key in the global interchange goods, base of general growth and wealth for companies and nations.

This importance and the importance of its continuity was even more stressed after recent shocks like the global COVID 19 pandemic (Meier & Pinto, 2024), where the disruption produced to this supply chains resulted in shortages of product and services and, in some occasions, in reducing the service level and affecting, among others, to the food security or the global health of the community.

Following (Ponomarov & Holcomb, 2009), we can define resilience of the supply chain as the adaptive capability of the supply chain to prepare for unexpected events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function.

Ports are core to these modern supply chains, as the key point of modal shift between the different transport modes, mainly between the maritime and the land leg of transportation. Maritime transport is responsible of around 90% of all the transport of goods worldwide, and ports, in both extremes of the maritime travel, are then key elements for performing smooth supply chains. Ports themselves have also evolved from its mere modal shift function to become privileged areas where a set of value-added activities are carried out to complement other logistics functions.

Ensuring the continuity of port activities is, thus, key for a resilient supply chain and, therefore, port resilience has become (even more) a must if we want to maintain and ensure the proper functioning of the global logistic system and the continuity of operations, protecting them from the so called port-centric supply chain disruptions, or PSCD (Loh et al., 2017).

3.2 Understanding port resilience

In this framework, port resilience become a paramount element if we want to achieve a real resilient supply chain and, thus, the competitiveness of a certain business, a certain sector or even a certain economy (Zhang & Lam, 2016).

To better understand what we can consider as port resilience we have to bear in mind the two realities of a Port:

- First, we should consider the physical reality of ports, at the intersection of land and sea in environments exposed to multiple hazards (e.g. climate related). This physical reality goes beyond the borders of the port to extend to the connectivity links with the global networks (e.g. the railway network connecting the port with the hinterland).
- Then the organizational reality of ports, where a diverse group of stakeholders (usually referred to as Port Community) interact to produce a certain service called “port service” also exposed at several risks (e.g. cybersecurity threads of port information flows).

Ports resilience due act in both levels, the physical and the organizational one as both are becoming the relevant assets and processes to be protected.

In the past port resilience was covered mostly from the physical perspective, focusing on natural hazards like earthquakes, tsunamis, fires, explosions and related disruptive episodes. Risk assessment has been the predominant approach to this physical resilience (Verschuur et al., 2022)

Recently the focus has changed also due to the more sophisticated nature of port management and organizational resilience as understood by (Duchek, 2020) is growing in relevance and the three stages of resilience, anticipation, coping and adaptation considered when addressing the port system resilience.

This evolution is related with the evolution of port organization itself. Initially, the same entity (the Port Management Body) usually provided what the UNCTAD considered the first-generation port services, where the mere modal shift from sea to land occurred and thus, any physical distortion affected a limited number of stakeholders and a number of activities.

Nowadays, in the subsequent three port generations, the port services provision was evolving towards the transfer of responsibility towards other stakeholders and now these same services are provided by the Port Community, where the Port Management Body is responsible for a limited part of the activities carried within the port, being other organizations, mostly private, the real performers of the port service. In this new situation, coordination of the different services, and the information flows that this coordination entails, are key for the port performance and, thus, for any kind of organizational resilience that can be considered.

A resilient port can be defined as “one that is able to maintain or minimize the impact of disruptions on its logistic, industrial and economic functions in a dynamic environment and is able to recover quickly from those disruptions by effectively mobilizing the resources available within its ecosystem”(Vanlaer et al., 2022).

In this new context, port governance reveals itself as an important element of port resilience, where the role of the Port Management Bodies (usually with the structure of Port Authorities) is key for ensuring this resilience and to coordinate the port community to achieve this resilience.

In the new geopolitical landscape, ports are both subject to new dangers and also new protection and also covered by specific regulation aimed to protect their public service nature. In this framework port has been considered critical infrastructure and, in this sense, included in the legislative framework focused in overseen the risk for this type of infrastructure, again,

both physically and organizationally. The Physical factors are related with the main physical assets required for the adequate functioning of a port system, including the maritime and hinterland connectivity infrastructure and the support elements required, for example, to ensure the proper communications within the system, while the Organizational is focused in the ”soft” assets that makes the essence of the good functioning of the port, including the way the port is organized, the workforce that supports it, the coordination of the Port Community and the information flowing within this Port Community (or Internal info-structure) that currently is in the essence of the services provided by the port.

As a first summary, we can consider the various factors influencing Port Resilience include in Table 1.

Table 1: Factors influencing Port Resilience by category*.

Physical	Organizational
Maritime Infrastructure	Port Governance model
Land infrastructure	Workforce organization
Hinterland Connections	Port Community coordination
Communication networks	Internal Infostructure

**Source: author’s research*

It is also worth to mentioned that, as the new organization and flow of the port services have produced new categories of factors influencing Port Resilience, new risks and potential disruptions have arisen due to a growing global concern as the climate change. Climate Change related effects are in their path to become the most recurrent source of port disruptions. From the increase in sea levels, the severity of weather phenomena and its consequences over both assets and processes to the burden posed on the work force by climate ill health related situations, Climate Change has surged as e new reality by itself.

On the other hand and bearing in mind the commercial role of port activities, once port operations are disrupted and the possibility to restore the complete functioning of the system is delayed, certain traffics can be diverted to other ports in the proximity or in the region. Once the port services are restored, nevertheless, some traffic may never come back, making the effect of the disruption a long-term impact in the port business.

3.3 Business continuity as a tool to cope with port resilience

According to the ISO 22301 standard, business continuity is an organization's capability to continue delivering products and services within acceptable timeframes, at predefined capacity, during a disruption. Like other ISO standards, ISO 22301 facilitates a framework helping organizations to address a complex challenge through a basic and ordered set of recommendation and requirements

From the port’s perspective, and bearing in mind the port resilience definition, the adoption of a business continuity approach allows ports to face the challenge of keeping resilient from the organizational perspective ensuring that the three stages of resilience are properly addressed.

As mentioned, ports are integrated in global supply chains, where global stakeholders participate and interact among them and with different ports. To ensure that these interactions, including data sharing along the chain, take place in a smooth and efficient way, standard approaches are required. E.g., if a global shipping line wants to call to different ports worldwide, common procedures applied in these various ports will facilitate the operation. Thus, global ports tend to follow the industry standards to ensure their proper integration in the chain.

This international and global perspective has made the international supply chain prone to standardization in their various levels. Various international organizations or associations have been working together to define these standards to make the global language of transport chains understandable.

As an example, when addressing the need to improve the environmental performance of ports, the adoption of global standards as the Environmental Management Systems (EMS), following the ISO 14000 or the EMAS scheme, has been a key tool to communicate to other stakeholders the port commitment (Kourmpeti, n.d.).

In this framework, and when coming to address business continuity, the adoption of standards looks like a smart approach if we want to be understood by different stakeholders. In this sense, ISO 22301 facilitates this standard approach.

Nevertheless, when selecting the ISO22301 as a tool to cope with port resilience shows some limitations. As Lindström (2010) recalls, Business Continuity Plans (BCP) puts their main focus in ensuring that Plans and Procedures exist more than how these processes can be accomplished in practice, and its implementation not always guarantee the correct addressing of the problem.

3.4 Business continuity applicability to the port sector

As in other management systems, one of the key aspects when developing a Business Continuity Management System (BCMS) is the decision about the final scope for the system, determining its boundaries and applicability. This question is addressed in point 4.3 of the ISO 22301 standard.

Understanding the mentioned modern functioning of a fourth generation port there are two possible levels for this scope:

- The Port Management Body
- The Port Community

When addressing this question, it is relevant to understand the responsibilities assumed when developing a proper BCMS. It's been already mentioned than the most common model applied for organizing a port system it is the Landlord model, where the Port Authority retains control of the land and provide general services, and the private operators carry out the main operations within the port.

Nevertheless, usually one of these services retained by the Port Authority is related with the safety and security of the port area and the global coordination of both maritime and land traffic.

The first approach, limiting the scope of the BCMS to the Port Authority, even if lacks completeness regarding all the port activities, makes it simpler in terms of assigning responsibilities over the system and could be the first step to ensure the proper continuity of the port system activities, while extending the scope to the rest of the port community provides a complete vision of the port service continuity and can be addressed in a second stage.

This duality is usual within the port industry and also appears when addressing other complex initiatives in the port, like with the definition of the Port Strategic Plan or the implementation EMS.

In the first case, the definition of a Port Strategic Plan, the Port Management Body (PMB) leads the port community during the process and the final product, the Port Strategic Plan is thus a common document combining activities that fall under the responsibility of the PMB and activities coordinated by the PMB but that fall under the responsibility of other members of the port community.

In the second, the implementation of EMS, the PMB limits its scope to the activities that are under its responsibility and the rest of the port community become stakeholders during the process. Subsequent adoption of EMS within the port community (sometimes with a common methodology) completes the coverage of the system providing a general framework for environmental protection in the port (Peris-Mora et al., 2005).

With a similar approach, s BCMS for the PMB is, in this case, a first step towards the general application of the BCP approach for the port community. It can set the path towards the adoption of the BCMS concept for the rest of the port community.

4. Case Study

4.1 The importance of the Port of Valencia in Spanish supply chains

The Port of Valencia is in the Mediterranean coast of the Iberian Peninsula. With the Ports of Sagunto and Gandia it is managed by the Port Authority of Valencia. The Port Authority of Valencia is a public body with independent budget under the supervision of the Spanish Ministry of Public Works through Puertos del Estado (forming the so-called Spanish Port System) and created after the Spanish Port Act from 1992. According to the Spanish legislation, the Port Authority of Valencia acts as a landlord, managing the physical assets belonging to the Port. In the landlord model, the Port Management Body (the PAV in this case) uses concessions and licenses agreement to ensure the proper functioning of the port processes. In the case of the PAV, it could also be considered an advanced landlord port as it provides a wide array of advanced services (like the Port Community System) to be used by the Port Community.

The port of Valencia is considered a Core Port according to Regulation (EU) 2024/1679, included in the Mediterranean Corridor, where it is the mayor contributor in terms of local cargo (Import -Export). In 2024 it was the 4th biggest container port in Europe (*Top-15 EU Container Ports in 2024*, n.d.) with a total throughput of 5.476 million TEU (TEU- Twenty feet Equivalent Unit) and number 24 globally in terms of connectivity (UNCTAD).

Table 2: Main European Container Ports.

Port	Throughput (1000 TEU)
Rotterdam	13,820
Antwerp-Bruges	13,528
Hamburg	7,800
Valencia	5,476

Nationally, the Port of Valencia is the largest commercial container port in Spain, handling around 40% of all Spanish domestic traffic.

The Port of Valencia is an example of the relevance big ports have over the supply chains using their services. The cargo throughput is divers, spanning from tile exports to car parts imports and perishable goods trade. Its hinterland covers much part of the Iberian Peninsula, being the natural port in terms of distance of the economic center of Spain, Madrid. A detail of the main cargo managed in the Port of Valenica is shown in Table 3

Table 3: Import/Exports through the Port of Valencia.

Cargo nature	Throughput (TEU)
Miscellaneus general cargo	433,390
Machinery and spareparts	286,254
Building materials	249,455
Chemical products	144,800
Wine & beberages	99,537

At the same time, the port is an economic powerhouse by itself, with an economic impact in the Valencian region (*Economic Impact*, n.d.) as shown in Table 4 in terms of Gross Value Added and job creation.

Table 4: Economic Impact of the Port of Valencia in 2019.

Cathegory	Impact	As a share of the Valencian Region (%)
Gross Value Added	3,216 b€	3.07%
Job	50,000	2.5 %

All these figures show how important ensuring the adequate resilience of the Port of Valencia is for the Valencian economy and how relevant any disruption of port services for the supply chain affected, from the car sector to the perishable goods delivery.

4.2 Building a Port Continuity Plan in the Port Authority of Valencia

Motivation

The Port Authority of Valencia pioneered the Spanish Port System regarding the first development of risk assessment methodologies and the development of the consequent contingency plans. This “safety” culture has been central to the port strategy when coping with the potential risks faced in the past. At the same time, due to its role as an advanced landlord, it committed itself to the protection of the different management processes set to produce the value-added services provided by the port Authority (i.e. cybersecurity regarding the Port Community System).

Nevertheless, and due to the more recent developments regarding regulation for the protection of critical infrastructure and a more complex environment, as put forward during the pandemics, the port managers understood that the risk-based tools already in place fell short of the required preparedness in this complex environment. After a care analysis of the different tools (see chapters 3.3 – 3.4) available to face these challenges, the development of a Business Continuity plan according the ISO22301 Business Continuity Management System was selected as a comprehensive approach to the problem. A management team was then selected and an advisor hired to help the port management team in the development of the System.

Phases of the development of BCP in the Port of Valencia

The first step was to define a roadmap for the implementation of a BCP for the Port of Valencia. In fact, the first key element was to clarify the real scope of the System, bearing in mind the differences from the Port Authority approach and the Port as a whole approach (as discussed in chapter 3.4). The Port Authority approach was selected as the most feasible and direct path towards introducing the Business Continuity concepts into the port management. Extending the system to the whole port was delayed to a second phase.

Once the scope was clearly defined, the following phases were decided:

- Phase I.- Defining the Port Value Chain
- Phase II. Continuity Requirements
- Phase III. Continuity strategies
- Phase IV. Recovery and Contingency Plans
- Phase V. Implementation

Phase I.- Defining the Port Value Chain

In order to help define the scope of the system and its boundaries, a proper definition of the main activities to be included within the system should be defined. The tool decided to clarify the boundaries was the redefinition of the Port Value Chain, where the main activities carried out by the different units where listed and grouped in services.

For this definition, the activities included where those related with the Port Authority as a PMB as defined by the Spanish legislation. According to the Spanish Port Act in its Article 5 Competencies, (*BOE-A-2011-16467 Real Decreto Legislativo 2/2011, de 5 de Septiembre, Por El Que Se Aprueba El Texto Refundido de La Ley de Puertos Del Estado y de La Marina Mercante.*, n.d.), we can find the following activities:

a) The provision of general services, as well as the management and control of port services to ensure that they are carried out in optimal conditions of efficiency, economy, productivity and safety, without prejudice to the competence of other bodies.
b) The planning of the port's service area and port uses, in coordination with the competent Administrations in matters of territorial planning and urban planning.

c) The planning, design, construction, conservation and operation of the works and services of the port, and that of the maritime signals entrusted to them, subject to the provisions of this law.
d) The management of the port public domain and maritime signals assigned to them.
e) The optimization of economic management and the profitability of the assets and resources assigned to them.
f) The promotion of industrial and commercial activities related to maritime or port traffic.
g) Coordination of the operations of the different modes of transport in the port area.
h) The organization and coordination of port traffic, both maritime and land.

Within this framework, a first draft of potential activities was developed by a selected team of port managers leading by the first author of this communication and including the units in charge of operations, safety & security, cybersecurity and governance. This task force, identified a total of 19 “Services” covering the above-mentioned list of Competencies

Then these services were categorized into three main sets:

Strategic Activities
- Strategic Planning
- External Relations
- Port-City Planning and Interaction
- Corporate Governance

Support Activities
- Electronic Administration and Documentation
- Risk Management
- Human Resources
- Occupational Health and Safety
- General Administration
- ICT
- Quality and Continuous Improvement
- Legal Services
- Marketing

Business/operations activities
- Operations
- Commercial and Customer service
- Services to the Port Community
- Safety, Security & Environment
- Infrastructure and Facilities Management
- Public Domain and Land Management

This first draft was then checked along the whole organization through a set of interviews where all departments were asked to define how these services where developed and, then, unbundled in processes. A total of 77 processes were identified. The main characteristics of the processes were then defined and the departments asked to develop procedures supporting each process.

The result of this first phase was the approval by the top management of a new Value Chain with all the documentation supporting the main activities carried out by the Port Authority of Valencia. This defined clearly the scope of the system, as it allows to determine the business processes that could be potentially included in the BCP.

Phase II. Continuity Requirements

Once the scope was defined, a detailed analysis of the Business Processes was carried out. For this, a consistent Business Impact Analysis (BIA) covering all the activities identified was applied, determining the impact types for the port activity, and how this apply to assess the impacts resulting from a disruption. Thus, for each activity the following elements, as defined by ISO 22301, where calculated:

- Maximum tolerable period of disruption or MTPD, related to the time frame within which the impacts of not resuming the activity would become unacceptable
- Recovery Time Objective (RTO), being the time frame identified for resuming the disrupted activity at a minimum acceptable capacity (that was also defined)

As a result, 35 processes were analyzed:

- 9 of them had a RTO of 4-12h
- 6 of them had a RTO of 24-48
- 15 of them had a RTO of 3-7 days
- 5 of them had a RTO of more than 7 days (these activities were subsequently considered no critical in the framework of the Business Continuity for the Port Authority.

This phase also allowed to identify both GAP analysis of the physical and logical assets relevant for these activities and also to develop an interdependency link framework within the different activities.

To complete the BIA, the potential disruptions were identified following potential threads to the Port Value Chain. These potential threads were identified based on previous experiences and after the analysis of potential distress caused to the relevant processes by the port officers. The list of potential threads was the following:

- Sabotage
- Unlawful actions against property
- Cyberattack
- Subversive activity and/or hacktivism
- Weather risks
- Geophysical Hazards
- Technical risks
- Diseases
- Supplier unavailability
- Terrorist attacks.
- Geopolitical risks

For each of these threads, a probability was defined. Then the impact to the related assets involved in the process was assigned and, thus, the risk calculated for each category of assets, including physical, logical, personnel and external services, applying the following equation:

$$R = P \cdot I$$

Where:

R – Risk

P – Probability. According to its level of occurrence, measured from 1 to 3, where 1 is the lowest and 3 is the top probability.

I – Impact. According to the level of affection to the asset, measured from 1 to 3, where 1 is considered the lowest impact and 3 the biggest.

With the results of these calculated risks, a heat map was developed, signaling the relevance of the risk according to both the probability and the impact.

Phase III. Continuity strategies

Once the BIAs carried out, a Business Continuity Policy was developed, integrating the main principles and commitments of the organization with the BCM. It was approved by the top management.

Then a set of Continuity Plans were defined covering the main elements of the Continuity Strategy for the Port Authority:

- Crisis Management, setting the organization and procedures facing a disruption and how to respond defining roles and responsibilities.
- Communication, both internally and externally including the identification of main stakeholders
- Recovery Plan, considering the various scenarios to be addressed within a potential crisis
- Testing, to check that the Continuity Plans are functionals and complete. Include both checking documentation and real simulacrum
- Maintenance of the system, ensuring how to update the Plans when needed.
- Training and awareness

Phase IV. Recovery and Contingency Plans

In this Phase, the main contingencies regarding the identified critical assets, both organizational and physical were identified and the procedures to follow to cope with them. In the form of Disaster Recovery Plans or DRPs, this set of procedures are linked with the previous scenarios identified on the previous phases.

Recovery was understood as the ability of the organization to become operational following the Continuity requirements set in Phase II.

Phase V. Implementation

Implementation is always the hardest phase in all Management Systems. Aware of this and bearing in mind the main limitation of the BCP implementation mentioned in chapter 3.3., the Port Authority of Valencia decided to use a Governance, Risk and Compliance scheme with the support of a dedicated software that allows the deployment of all documentation, the assignment of roles and responsibilities and the mechanisms required for updating the system. Also in this phase, the clear commitment of the top management and of the Business Community team created to maintain the system was of paramount importance.

5. Conclusions and further research

Given the relevance of supply chains to support the global economy, ensuring their resilience in face of disruption is a must. This requires a proper Port resilience definition and the identification of the organizational requirements that this implies.

The implementation of Business Continuity Management Systems following the model provided by the ISO 22301 reveals itself as a useful tool for dealing with this challenge. The fact that, being a recognised standard, easily reveals to stakeholders the commitment of the port with resilience, is also a major reason for adopting this type of schemes.

In this framework, the role of the Port Management Body in leading the process of implementing BCMS in a defined port environment can have a double effect: covering the

general services offered to port users and promoting the adoption of the standard to other members of the Port Community.

The application to a big commercial port as the Port of Valencia shows how this theoretical approach can function in practice, and a practical roadmap towards its implementation could be developed.

At the same time, it shows its limitations when it comes to addressing the real disruption challenges and the continuity of the main port processes.

Using the Spanish port system, and the Port Authority of Valencia in particular, as a reference, we have identified the following limitations that should be addressed:

- The need to better define the scope of the System, through a better identification of the key activities and processes to be assessed within the system, in order to efficiently assign resources.
- Bearing in mind that the service provided by the port goes far beyond the Port Management Body boundaries, a more opened Port Community approach should be considered. In it, a multiagent system should be defined and a new approach to the implementation of the BCMS considered.

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Use of Generative Artificial Intelligence

No generative artificial intelligence was used in preparing this communication.

Communication aligned with the Sustainable Development Goals