

# RISK AND RESILIENCE

## GUIDELINES FOR PORTS

A structured process  
of defining and  
inventorising risk,  
managing  
stakeholders and  
building a resilient  
operational model

## ABOUT IAPH

Founded in 1955, the International Association of Ports and Harbors (IAPH) has developed into a global alliance of 169 port authorities, including many of the world's largest port operators as well as 134 port-related businesses. Comprised of 87 different nationalities across the world's continents, member ports handle approximately one third of the world's sea-borne trade and well over 60% of the world container traffic. With its NGO consultative status recognized by the IMO, ECOSOC, ILO, UNCTAD, UNEP, and WCO, IAPH leads global port industry initiatives on decarbonization and energy transition, risk and resilience management, and accelerating digitalization in the maritime transport chain. Its World Ports Sustainability Program has grown into the reference database of best practices of ports applying the UN Sustainable Development Goals and integrating them into their businesses.

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## PREFACE

With the outbreak of the global COVID19 pandemic late in the first quarter of 2020, we were witnessing an emerging global crisis that threatened the world economy. As such, IAPH decided to act decisively by setting up a member-led COVID19 taskforce in order to provide support to ports at the sharp end of the pandemic peaks as they spread Westwards across the planet. First weekly, then bi-weekly survey-based reviews on the global ports situation were gauged by the Taskforce with our COVID19 port economic impact barometer report. A WPSP-IAPH guideline was developed for ports during the first and second waves based on best practices acquired in Asian ports in particular as well as advanced global port experts from our membership, with the support from the World Bank and UN agencies.

The lessons learned then and the identified need to improve and strengthen port resilience resulted in IAPH establishing its Risk and Resilience Committee as a principal strategic area of interest alongside its Committees for Climate and Energy and Data Collaboration.

Applying the same pragmatic approach by the Taskforce, this guideline is the first IAPH tool produced by expert regular and associate members from this Committee which aims to support ports in establishing a structured approach towards risk management, business continuity and organizational preparedness. The case studies we are populating on our World Ports Sustainability Portal to support these guidelines are as important as this base guideline, so I appeal to you to share your experiences with us on how your port has effectively dealt with specific risks. Effectively managing business continuity during the next crisis has become an essential port requirement – this living document will evolve along the path of continuous improvement with our members.



**PATRICK VERHOEVEN**  
**MANAGING DIRECTOR IAPH**

## FOREWORD

Being a primary enabler of globalised trade, the port sector has faced a series of black swan events in the last years. As a vital node in the global supply chain, the ripple effect of small impacts on operational efficiency is felt throughout the entire supply chain, emphasising the criticality of assessing risk and building resilience. A local port disruption can have secondary and tertiary effects elsewhere.

During the COVID-19 pandemic, governments around the world were quick to recognise those working for ports in the supply chain as essential workers, protecting the essential flow of goods through the world's ports. Port operators recognised the need to not only remain relevant and provide the services demanded (business as usual) but to be agile both in the face of adversity and in the face of opportunity.

Never before has risk and resilience been considered so widely, with operators in all sectors expediently adopting measures to increase their resilience maturity. Customers expect that ports will remain operational regardless of adversity, typically building the foundation of their supply chain on this assumption.

The port sector has embraced these challenges and has driven forward, exploring supportive technology and adopting appropriate solutions at increasing speed. Developing business continuity models is a crucial component of the risk assessment process, whether considering climatic change, supply chain disruptions or the implications of widespread illness within your operation.

Technology can doubtlessly support, providing greater insight through data modelling and delivering operational efficiencies. In adopting technological solutions, many large ports admirably continue to support businesses, providing vital information technology/operational technology infrastructure that might not otherwise be in reach. Recognising that each individual port will face different challenges depending on size, location and operations therein, identifying potential vulnerabilities is decisive in delivering resilience.



**MICHAEL YARWOOD**  
**TT CLUB**

## RISK AND RESILIENCE IN CONTEXT

*By Niels Vanlaer, BCM & Harbour Master, Port of Antwerp-Bruges, with inputs from Shri Madiwal, Harbour Master, Vancouver Fraser Port Authority and Ingrid Boque, Global Strategic Networks Officer, Hamburg Port Authority.*

Ports have always played a critical role. Their unique position and their vital role in the support of a nation's economic activity reaches well beyond their critical role as the nodal link between the maritime and intermodal supply chains. At the same time, they can be very vulnerable to all kinds of risks and changes: internal, external and environmental. Therefore, the need to have efficient and resilient ports is of paramount importance.

We don't have to go back too long to find examples of terrorist attacks, natural disasters or political decisions affecting the operations of a port. At the same time, ports also face internal threats, ranging from temporary blockages of their access waters, roads or railroads, oil spills or protest actions to industrial accidents that hamper safe operations in larger areas of the port.

Next to those short term events, there are also more slow-burning and often long-term changes in society that affect ports in one way or another. Think of social conflicts, the changing view on the climate and environmental impact of ports and their activities, the infiltration by criminal organisations into port activities or the challenges to attracting new talent or find trained and qualified port personnel.



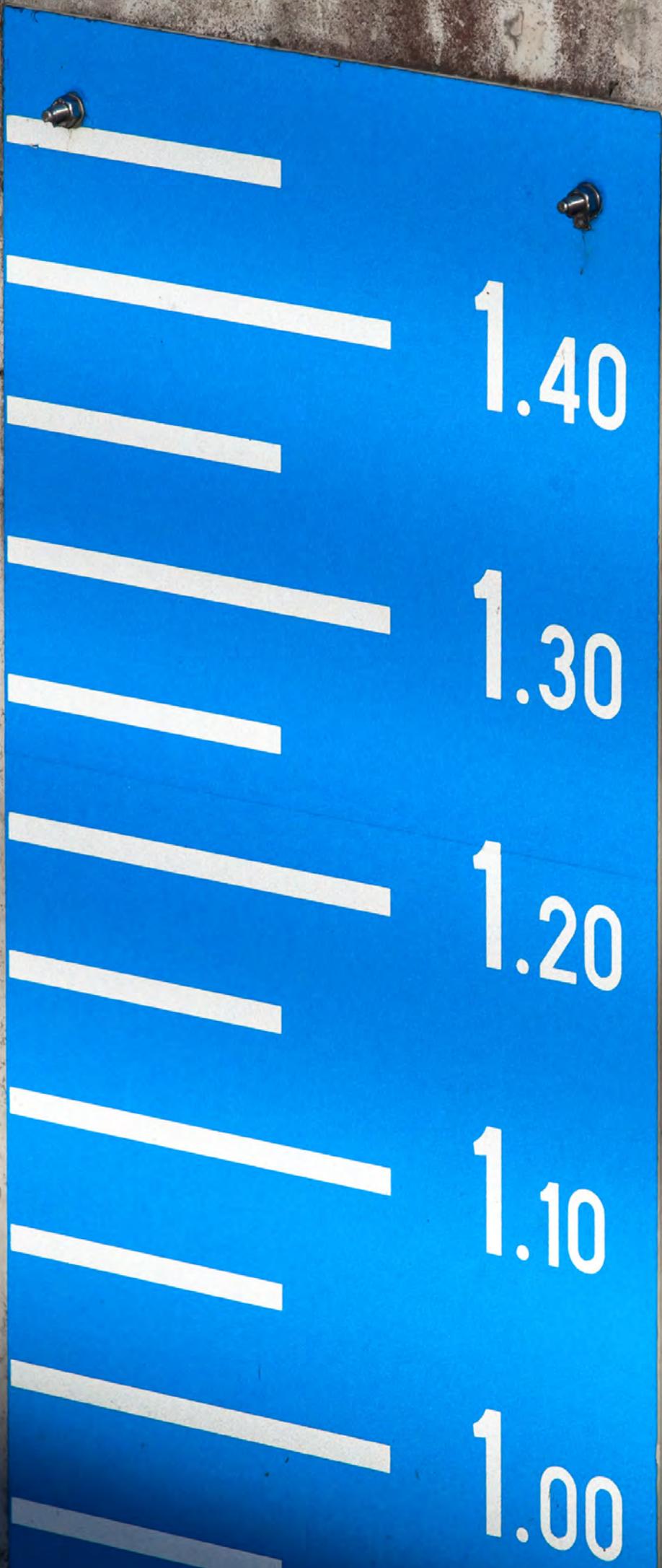
Niels Vanlaer



Shri Madiwal



Ingrid Boque



# 1

## DEFINING AND INVENTORISING RISK

### 1.1. Defining risk

According to ISO 31000 (2018), risk is the effect of uncertainty on achieving the objectives, often quantified as the Likelihood of the occurrence of an event multiplied by its Impact (L x I). While risk is generally perceived as a negative thing, we should keep in mind that it can just as well be a positive outcome, linked to a certain likelihood (i.e. an opportunity).

A second point to be aware of, is that likelihood can be treacherous and therefore our understanding of the risks that we face is biased – and too often on the positive side. When we look at frequent events, we can perfectly determine the probability at which they occur and we can take the necessary measures of prevention, mitigation and response. However, for larger impact incidents – the so called “High Impact – Low Probability” events – our estimation skills become blurred. We tend to ignore them because either their impact is beyond the imaginable, or because we don’t believe they will ever happen.

Finally, we must also be aware of hidden risks due to the accumulation of smaller separate threats which happen to come together at the wrong place and time, setting off a cascade of secondary events. This can happen on a local scale (e.g. within the port) but also on a larger scale (e.g. over the supply chain). An example in port could be a nautical accident that creates terminal congestion, which leads to road blockages of trucks hampering the access of emergency services.



## 1.2 Inventorising risk

Only when the context in which the port operates is understood, one can look at the actual events which happen at the sharp end of the operations.

The following list illustrated in IAPH *Risk & Resilience Infographic 1* provides a non-exhaustive number of events that could lead to port disruptions:

**ECONOMIC FACTORS:** competition from other ports, adverse economic climate, bankruptcy of a major port user, seasonality

**ENVIRONMENTAL FACTORS:** pollution, seismic events, adverse weather, hydrological hazards, unexploded ordinance

**HUMAN FACTORS:** terrorism and crime, events (community and sports events, military exercises,), industrial action, human factors in decision making or operations, epidemics

**ACCESS FACTORS:** marine access, land access, official inspections (customs, security,)



**NETWORK FACTORS:** disruptions further up or down the supply chain, disruption events at other major ports or in the hinterland

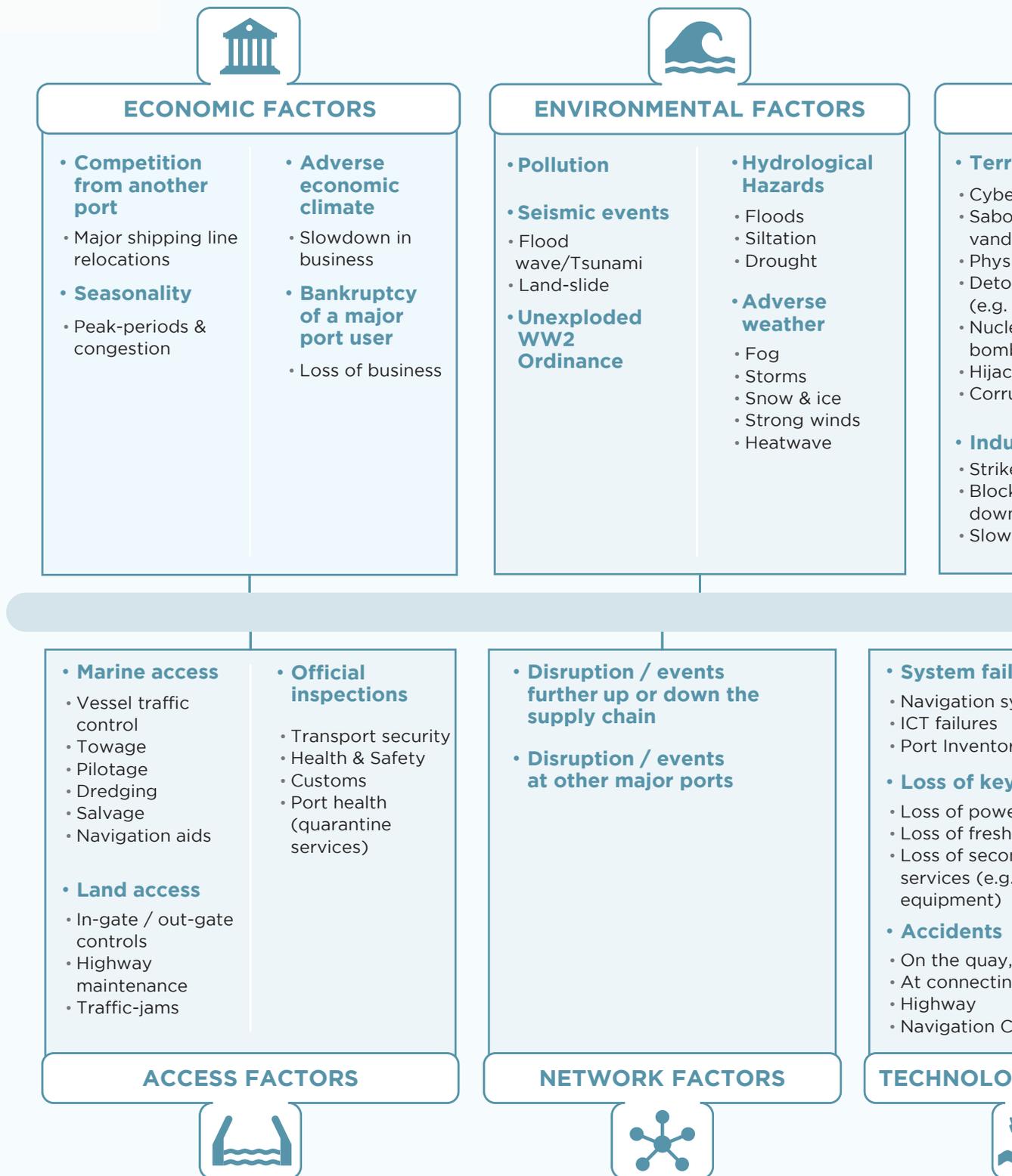
**TECHNOLOGICAL FACTORS:** system failures, loss of key utilities, accidents

**ORGANISATIONAL FACTORS:** insufficient resources, general confusion or lack of planning, ineffective communication, poor planning, conflicts with contractual and statutory obligation, bureaucracy, conflicting priorities among stakeholders.

Many of these events are already covered one way or the other; think of oil pollution or breaches of security: every port has regulations, procedures, trainings and resources to deal with such an event. However, next to the type of incident, the extent to which the possible event must be addressed must be carefully assessed. What is the span of control of a port? How is its relation to other authorities and emergency services? Most ports will be ready to tackle a typical small oil spill. But how many ports would be ready to take on a massive spill of a ruptured bunker tank?



# INFOGRAPHIC 1





### HUMAN FACTORS

#### Crime & crime

• Terrorist Attack/Hacking  
 • Hijacking, theft & piracy  
 • Terrorism  
 • Chemical attack  
 • Contamination of cargo (e.g. oil tanker)  
 • Nuclear device / dirty bomb  
 • Kidnapping  
 • Insurance fraud

#### Events

- Campaigns & demonstrations
- Military mobilisation
- Civilian repatriation or evacuation by sea (e.g. when airspace is closed)
- Based sports events

#### Human errors

- Decision making errors
- Operating errors

#### Epidemics (e.g. flu)

- Loss of staff
- Infected crew / passengers

#### Industrial action

• Strikes  
 • Lock-outs  
 • Slow-down

## RESILIENCE IN A PORT CONTEXT

A resilient port is a port that is able to maintain its logistic, industrial and economic functions in a dynamic environment and which is able to recover fast from disruptions by effectively mobilising the necessary resources available within its ecosystem.

### EFFECT



PORT DISRUPTION CLOSURE

#### Resources

• System failures  
 • IT System failures  
 • Utilities  
 • Power supply  
 • Cooling water / cooling water  
 • Maintenance and materials handling

• Terminal or berth  
 • Dredging ports

• Channel

### LOGICAL FACTORS



#### Insufficient resources

- Staff/ labour
- Shore-based equipment
- Experts
- Critical equipment

#### Bureaucracy

#### Intervention by authorities

- Conflicting priorities among port stakeholders

#### Ineffective communication

### ORGANISATIONAL FACTORS



#### Poor planning

- Lack of risk awareness
- No system wide resilience planning
- No business continuity planning
- Insufficient training

#### General confusion / lack of planning

- Conflicts with contractual and statutory obligations

# 2

## MANAGING STAKEHOLDERS

### 2.1. Defining risk in the context of the port in its environment

Risks always present themselves within a certain context and we must be aware of that: *“if you have seen one port, you have seen one port”*.

It is therefore crucial for ports to understand the environment in which they operate, and what the vulnerabilities within that environment are. A first convenient step is for each individual port to evaluate its span of control and influence using the PESTEL model illustrated on the next page.

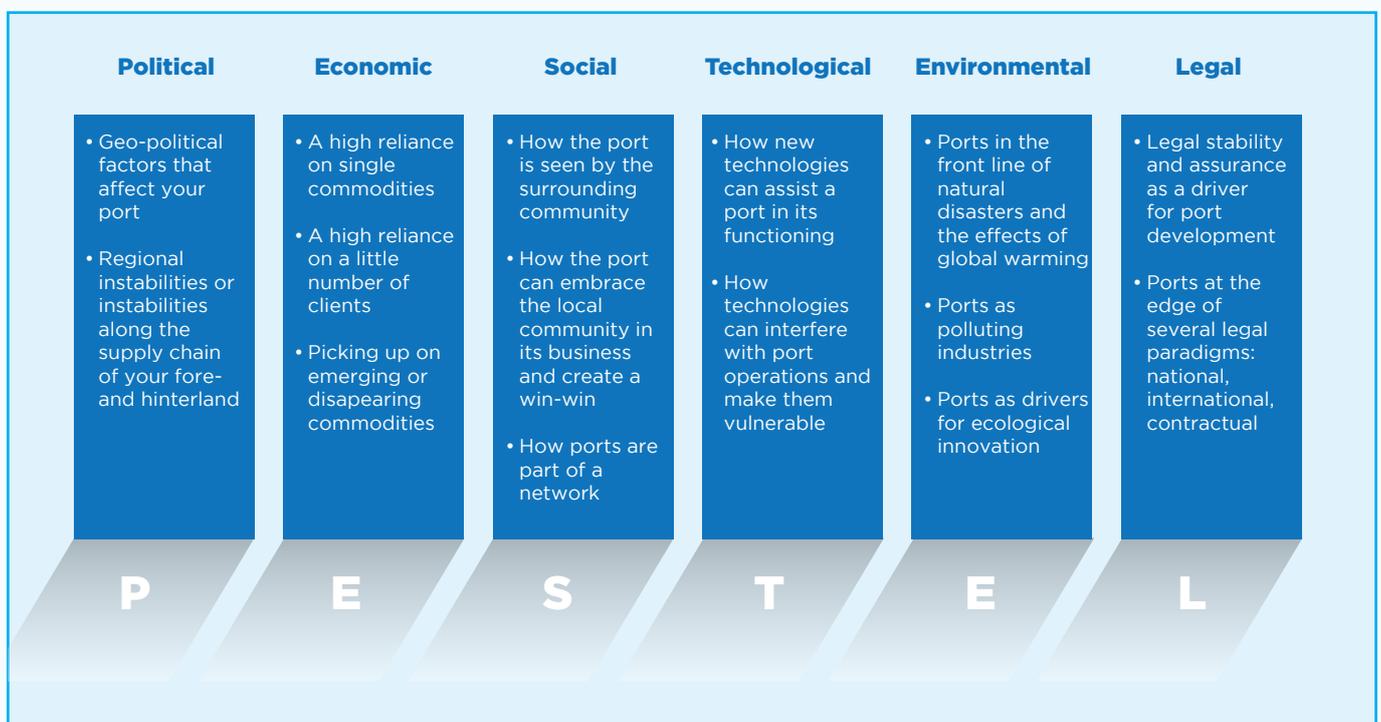
A second relevant consideration involves the Internal factors that affect the context of the port:

- Mission, vision and values: these relay directly to the above-mentioned definition of risk: what is the objective of the Port (Authority)?
- Governance and structure of the port, including roles and responsibilities
- Dependence on technology and level of digitalization in planning and supply chain systems.
- Organizational culture of the port
- Resources of the port: these include financial resources, but just as well human capital, knowledge and technology.
- Relations with stakeholders: how does the port ecosystem function?

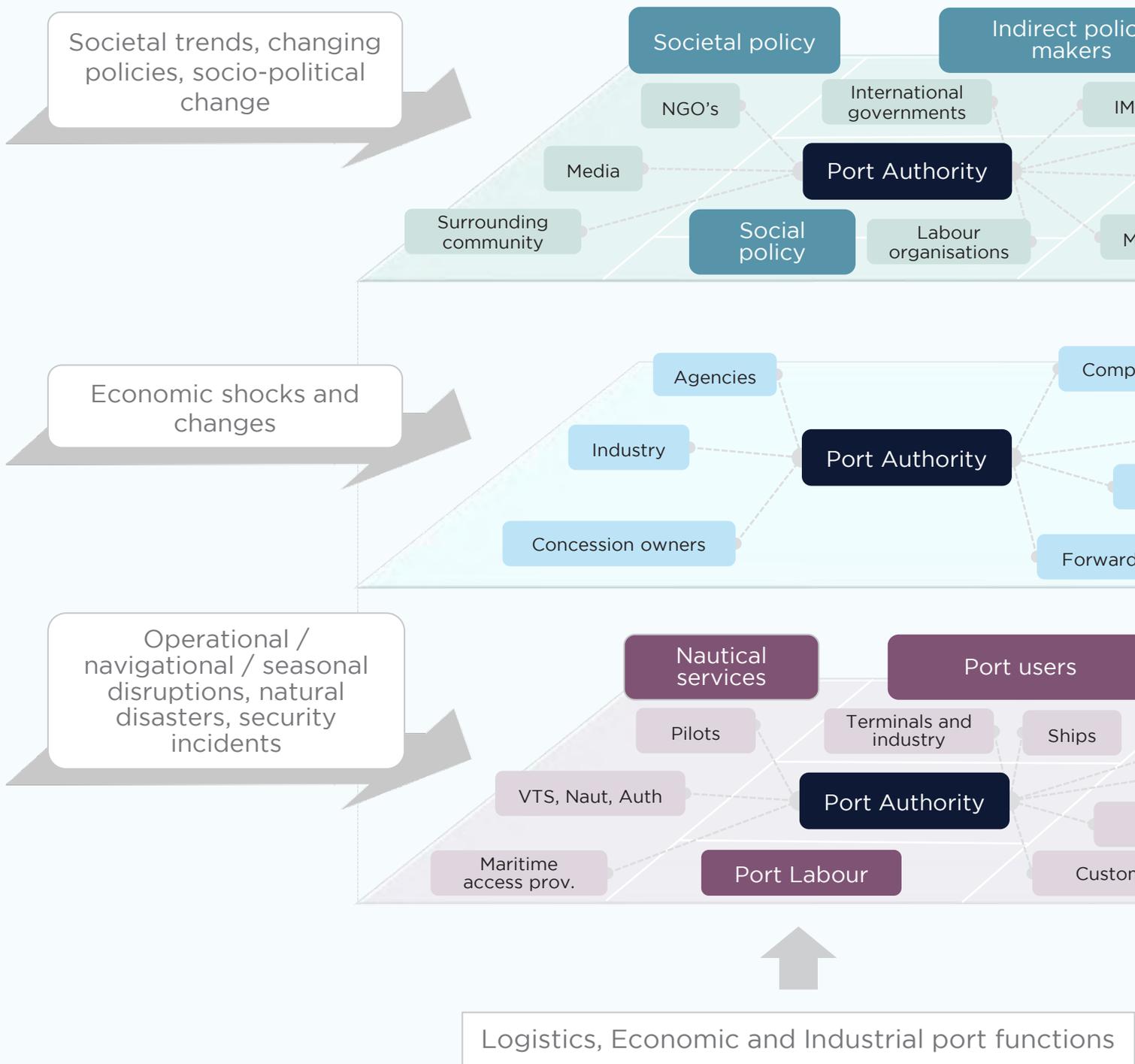
Thirdly, it should be well understood on what level we actually want to assess the risks:

- on the operational level of the port (i.e. the port authority as a single organisation);
- on the economic activity of the port as the logistics platform (i.e. including all the local stakeholders and those services provided internally or by third parties);
- or on the port as a nodal organisation which influences and is influenced by policy makers within the local (and wider) economy and society

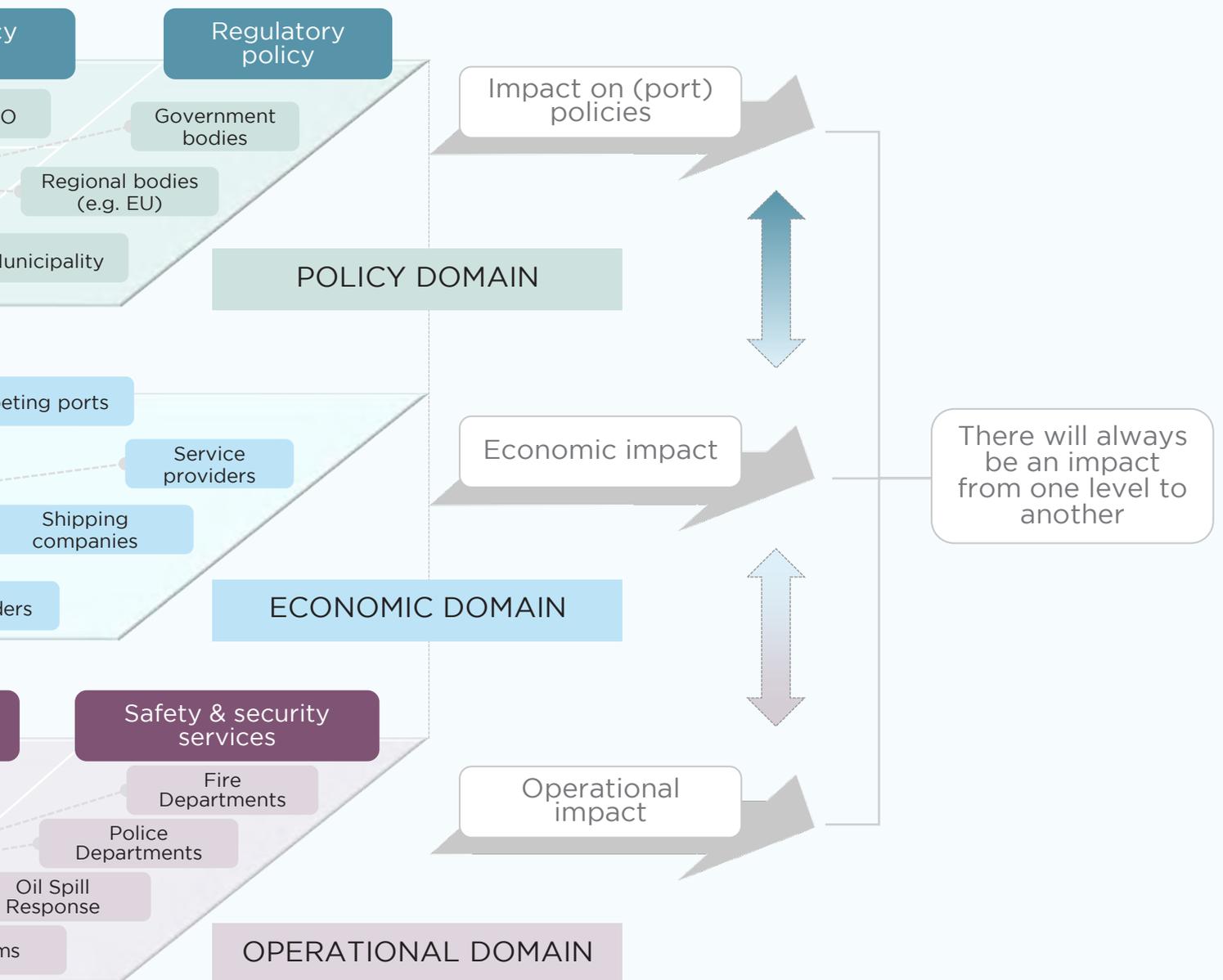
Depending on the business model of a port and its span of authority, it can uniquely influence and be influenced by stakeholders on all three of these levels. This is not the case for the other stakeholders in port risk and crisis management. This is exceptional in the sense that a port has the potential to play a pivotal liaison role in managing and mitigating a specific risk or crisis as it unfolds. This is best explained by IAPH *Risk & Resilience infographic 2* which is an illustrative guide on the potential spheres of influence a port authority connects with on an operational, economic and regulatory level. The infographic serves as a guide for ports to brainstorm themselves as to what their own port ecosystem looks like, namely a) their existing relationship with each stakeholder on each of the three levels and b) what they can or cannot control or influence in terms of mitigating or responding to a specific risk in *infographic 1*.

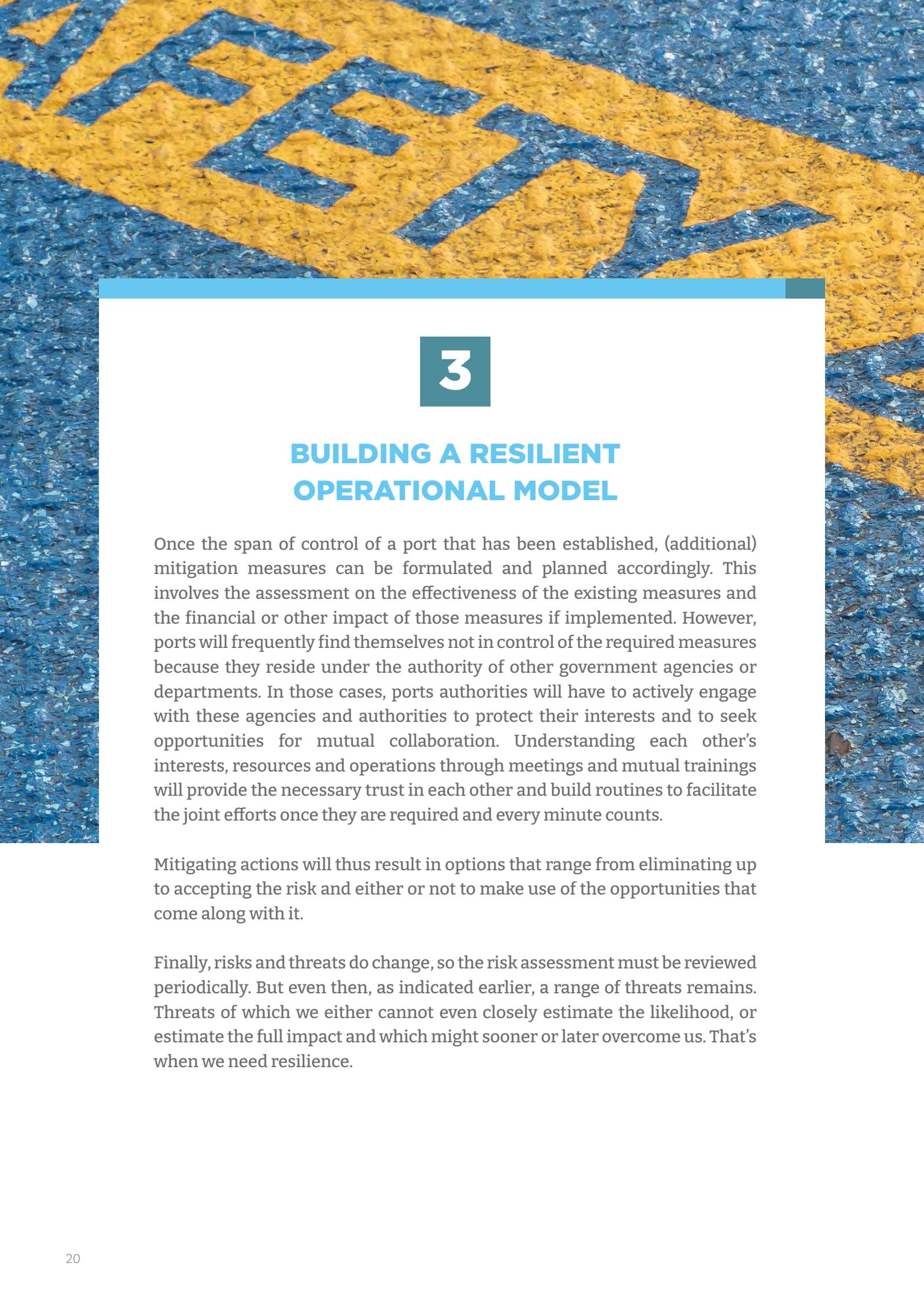


## DEVELOPMENT OF AN ORGANISATION



# ANAL RESILIENCE MODEL FOR PORTS





# 3

## **BUILDING A RESILIENT OPERATIONAL MODEL**

Once the span of control of a port that has been established, (additional) mitigation measures can be formulated and planned accordingly. This involves the assessment on the effectiveness of the existing measures and the financial or other impact of those measures if implemented. However, ports will frequently find themselves not in control of the required measures because they reside under the authority of other government agencies or departments. In those cases, ports authorities will have to actively engage with these agencies and authorities to protect their interests and to seek opportunities for mutual collaboration. Understanding each other's interests, resources and operations through meetings and mutual trainings will provide the necessary trust in each other and build routines to facilitate the joint efforts once they are required and every minute counts.

Mitigating actions will thus result in options that range from eliminating up to accepting the risk and either or not to make use of the opportunities that come along with it.

Finally, risks and threats do change, so the risk assessment must be reviewed periodically. But even then, as indicated earlier, a range of threats remains. Threats of which we either cannot even closely estimate the likelihood, or estimate the full impact and which might sooner or later overcome us. That's when we need resilience.







### 3.1. Defining resilience

Resilience is described as the ability to bounce back after a disruptive event. It is used in a variety of contexts: ranging from paediatric psychology to the military. While it might be perceived as a buzzword by some, it turns out to be an important characteristic of individuals and organisations in today's fast evolving world.

Hollnagel, defines organisational resilience as follows: “An organisation’s performance is resilient if it can function as required under expected and unexpected conditions alike (changes/disturbances/opportunities)”<sup>I</sup>.

Another definition of organisational resilience is “the process by which an actor (i.e., an individual, organization, or community) builds and uses its capability endowments to interact with the environment in a way that positively adjusts and maintains functioning prior to, during and following adversity.”<sup>II</sup> From a port perspective this is a particularly useful definition as it points beyond the individual organization and refers to the (port) community as a whole ecosystem as well as emphasizes the interaction with its environment.

These definitions also go further than “bouncing back”. It also means that a resilient organisation is ready to act on all kinds of changes: the bad ones (disruptions) but also the good ones (opportunities); the rapid changes (disasters) but also the slower changes (e.g. climate change).



<sup>I</sup> Hollnagel, Safety-II in Practice, 2018

<sup>II</sup> Williams T., Gruber D.A., Sutcliffe K.M., Shepherd D.A., Zhao E.Y., (2017), Organizational response to adversity: fusing crisis management and resilience research streams, Academy of Management Annals, p. 742.

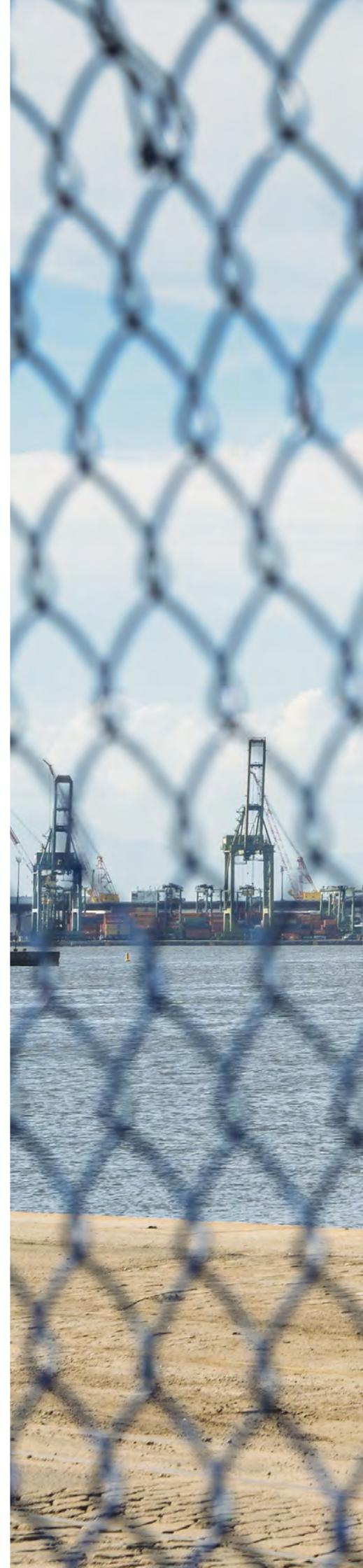
## 3.2. Resilience in ports

Therefore, if we want to make our ports more resilient, we must make sure that we are prepared for disruptions and disasters: both the ones we identified as risk, but also the ones that come as a surprise. We must be ready to respond to those that we can respond to and be sufficiently flexible to improvise our response to the ones we cannot prepare for. Finally we must learn from our own incidents, but also be ready to share our incident history with other ports so that we can create mutual learning.

IAPH *Risk & Resilience Infographic 3's* organisational resilience model for port authorities on the next pages provides a schematic overview containing the different baseline elements of resilience before, during and after an event. It shows those elements relevant to the policy domain, to the economic domain and to the operational domains respectively illustrated in IAPH *Risk & Resilience Infographic 2* for all the risks inventorised in IAPH *Risk & Resilience Infographic 1*. All three require different focus points in anticipation & preparation, in coping with the unexpected event and in learning from the event.

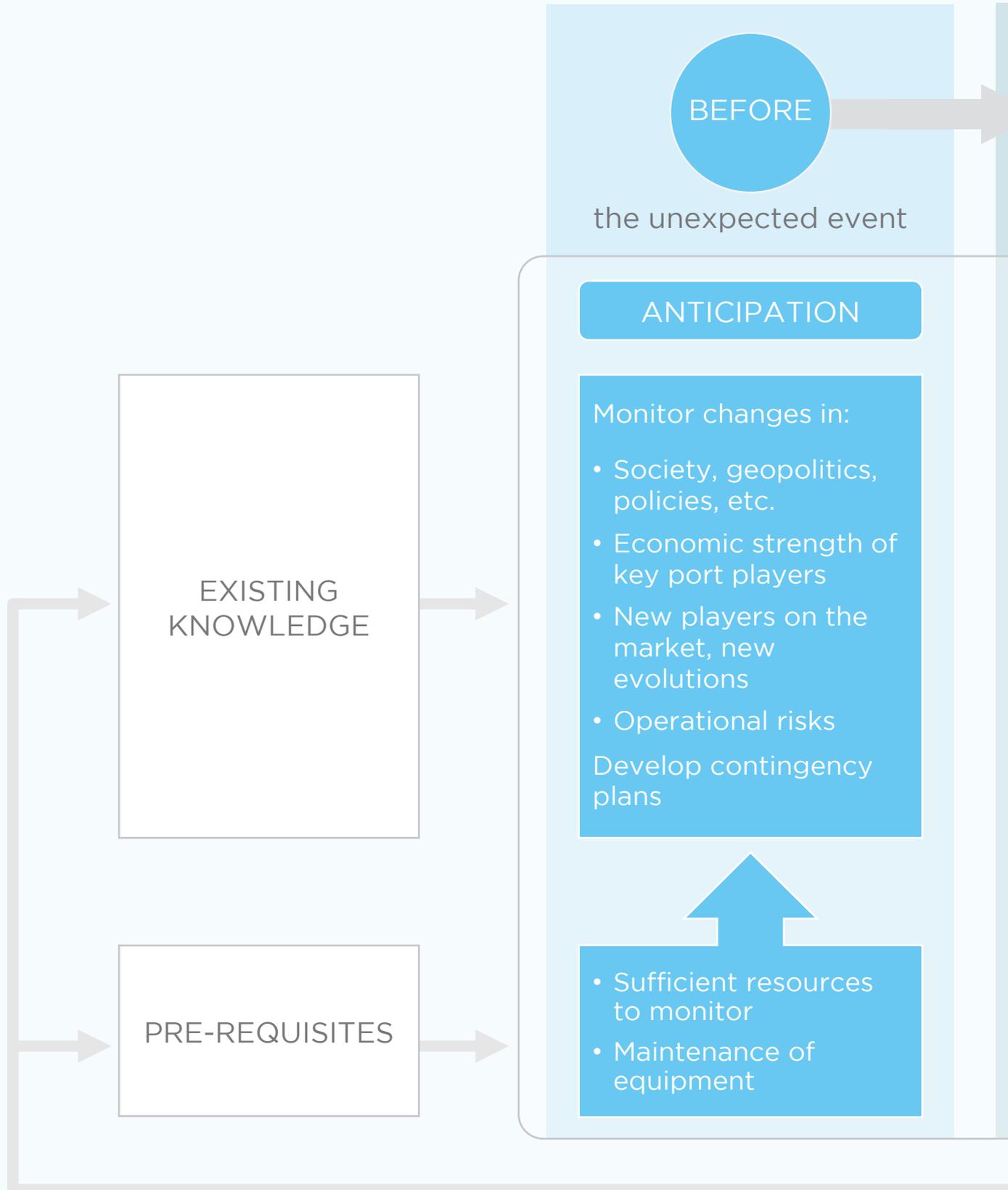
On the policy and economic domains Risk and Chance Management (RCM) is a corporate management tool. It addresses all relevant risks and opportunities that may arise within the scope of the corporate supervision and responsible corporate management. The aims of RCM are to ensure that tasks are performed efficiently, and that economic planning is adhered to by acting in a risk-conscious manner. The aim is not simply to avoid potential risks, but rather to create room for improvement in order to exploit existing opportunities, including those arising from decisions that tend to be risky. The organisation's results are improved by identifying significant threats or missed opportunities in time and taking appropriate countermeasures.

On the operational domain, planning (including for secondary and tertiary risks), developing the network of stakeholders and learning from adversities on multiple levels (i.e. the work floor as well as management) make sure that disruptions are tackled as efficiently as possible with a minimum impact on the port operations, the environment and the wider region.

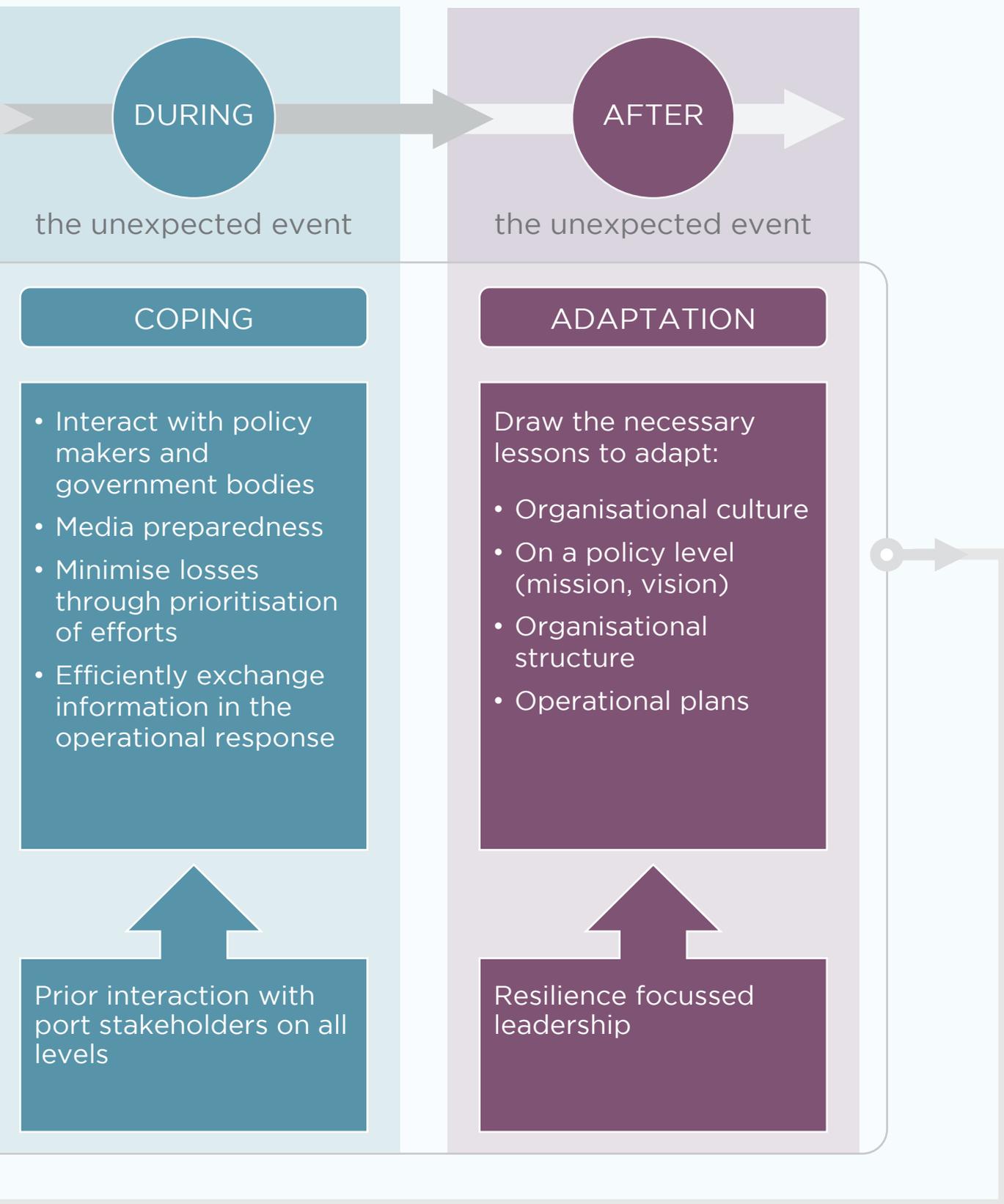




## ORGANISATIONAL RES



## RESILIENCE MODEL FOR PORT AUTHORITIES



## SUMMARY OF RECOMMENDED ACTIONS

### HOW TO USE THIS GUIDELINE AND USING THE IAPH WORLD PORTS SUSTAINABILITY PROGRAM RISK INVENTORY PORTAL

This guideline has been designed as a pragmatic, practical tool that can be applied by a port irrespective of size, technical characteristics or governance model.

1. By accurately **DEFINING AND INVENTORISING RISK** (using Section 1 and *IAPH Risk & Resilience Infographic 1*), a port can evaluate its current capabilities and perform a gap analysis in terms of risk preparedness, prioritising the most likely events that could impact its operations
2. By correctly identifying and planning how to **MANAGE STAKEHOLDERS** (using Section 2, the **PESTEL MODEL** in section 2.1. and *IAPH Risk & Resilience Infographic 2*), a port can evaluate its span of control and influence, consider internal factors that affect the context of the port, and assess risks on operational, economic and wider societal and regulatory perspectives
3. By defining resilience in its own context (using Section 3 and *IAPH Risk & Resilience Infographic 3*) a port can evaluate the different baseline elements of resilience required before, during and after an event for the policy domain, the economic domain and the operational domains illustrated in *IAPH Risk & Resilience Infographic 2* for the risks inventorised in *IAPH Risk & Resilience Infographic 1*

While the outcome of this three-step exercise will never cover every eventuality that can happen to a port, the aim is provide a straightforward framework to establish the groundwork for an effective risk and resilience strategy that offers a focus for a port organisation, its constituents and stakeholders and the port's ecosystem at large.



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