SHIPPING Network
The official magazine of the Institute of Chartered Shipbrokers
ROYAL CHARTER Centenary 1920-2020
Promoting professionalism in the shipping industry worldwide
Issue 71 December 2022

INNOVATE AND GROW

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Stacking the odds in favour of change and innovation

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Change management is a difficult undertaking for any organisation, even when operating under a strong command and control mandate. For a self-organising ecosystem, such as the shipping industry, it is even more daunting because large-scale positive change is dependent on collaboration and co-operation across a wide range of stakeholders.

Topic: Maritime informatics

Keywords: Data, change management, standardisation

Background: The concept of standardised layering could help the maritime industry effect change

We can learn from the computer industry, which has self-organised its way to massive success over the last half-century by building stack architectures. It relies on standardised connections between layers to enable effective and efficient coordination that significantly reduces the complexity of building large software systems.

In the computer industry, a stack is composed of discrete layers of connected hardware or software that communicate with their immediate neighbouring layers via standard messages. For example, a solution stack is a set of integrated software that provides a platform for applications. WAMP, a popular applications stack, consists of Windows as the operating system base, with Apache above it as the Web server, then MySQL as the database management system, and finally, on top, PHP, Perl, or Python as the application programming language.

Because the computer industry has standards for communicating between layers, the components are interchangeable. WAMP can become MAMP by substituting Mac OS for Windows or convert to WINS by exchanging Internet Information Services for Apache. Firms can specialise in a layer, such as data management, rather than having to build a complete application development product. In addition, a stack model enables competition within layers and thus encourages innovation.

The stack is an idea that the maritime sector might explore to reduce the complexity of change.

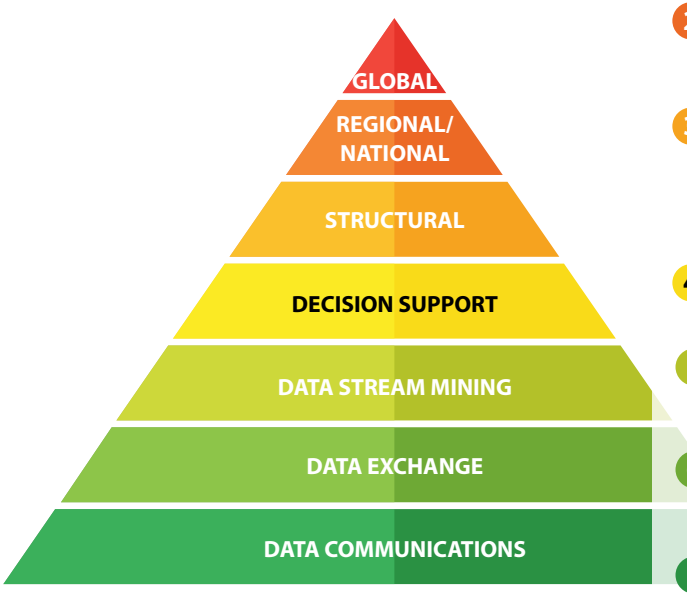
Seven-layer model

The benefits and ramifications of innovation in an industry with many interdependencies are difficult to forecast when boundaries between actors are non-standard. Plug-n-play is infeasible because the plugs are not consistently defined. As a result, change is challenging and the returns from innovation are difficult to reap because one-size does not fit enough. General morphological analysis (GMA) is a method for decomposing any eco-socio-technical system, such as shipping, into clearly defined standardised interdependent elements. The first step of GMA is to identify and define the primary components. Based on our analysis, we propose a seven-layer model for managing industry or regional wide change in shipping (shown in the graphic on page 21). While we will focus on a large-scale digital transformation, the principles apply to any major structural shift.

Each layer must communicate with its immediate neighbour(s) in a standardised manner to enable a high degree of independence between layers. In addition, decision rights should be allocated to a layer and not across layers. Thus, someone working on the data communications layer can't interfere with the deliberations of the data exchange team. Of course, there needs to be collaboration between layers to ensure effective connectivity between them. This enables developments in each layer to occur relatively independently, provided communication protocols with adjacent layers are obeyed. For example, one layer might create a policy, which the layer beneath would implement. It is a common principle in government to separate the legislative and executive branches, though the principle is often muddied by politics. While the precept of separating decision rights is sound, it is the practice of separation that makes it effective.

In the case of the maritime industry, we observe that the highest level of activity is in the structural layer as the major stakeholders dynamically adjust to societal pressures and new regulations. The structural layer is where economic entities are fashioned and refashioned by competition. Their ability to generate wealth and drive productivity gains, however, is dependent on the entire stack.

Layers of the Maritime Informatics stack



Credit: Watson, R. T., Lind, M., Delmeire, N., & Lieaa, F. (2020). Shipping: A Self-Organizing Ecosystem. In M. Lind, M. P. Michaelides, R. Ward, & R. T. Watson (Eds.), Maritime Informatics: Springer.

1. Industry-wide international standards for digital data exchange within the maritime sector.
2. Design and implementation of policies to support a digitally enhanced maritime sector and a regional/national excellence in Maritime Informatics.
3. Design of structures, such as markets, organizations and partnerships to implement efficiently frequently occurring maritime decisions in a digital era. These include shipping conferences and long-term contracts between shipping companies and terminal operators.
4. Design of decision processes and associated actions to implement frequently occurring maritime industry decisions.
5. Design of techniques for dynamic identification of model parameters to support real-time decision processes in the maritime sector.
6. Design of message formats and content for data exchange between elements of a maritime system to support decision making.
7. Design of data communication networks to capture data for decision making at the appropriate level of granularity and frequency and transmit control commands to connected maritime equipment and devices.

Stimulating innovation

Astute boundary observers will see opportunities to change the operation of one layer so that it creates an entrepreneurial opening in another layer. For example, a new data exchange standard creates a chance for establishing new data mining procedures to feed a new decision support system. Thus, to encourage productivity enhancing change, the leaders of each layer need to reflect and focus on how innovations and performance improvements in their layer can have ripple effects on their neighbours. Thus, a maritime stack should not cement relationships in place, but rather be designed to support an agile, resilient, and functional ecosystem with separation among distinct activities to confine major change effects to one layer and allow the others to gradually adjust as required.

The International Maritime Organisation (IMO) developed a reference data model for the industry, which we place in layer 6 (data exchange) of our stack. The IMO might benefit from leveraging our seven-layer model for building a shipping stack, which would help stimulate digitalisation of shipping through establishing an environment conducive to innovation. As a first step, it could match its planned industry harmonisation efforts to specific layers of our framework.

Our stack model illustrates the concept of decision layers with the goal of stimulating the development of a formalised industry model. Our goal is to communicate to all stakeholders how a self-organised industry can reduce the burden of change and promote innovation. Both, the right to self-organise and innovate are major drivers of productivity gains and growth, and our aim is to multiply their reinforcement.

Despite the progress and positive impact of organisations like the Digital Container Shipping Association (DCSA), which aims at furthering digitalisation through technology standards in container shipping, standards are often seen as hindrances to innovation. The computer industry, however, has clearly demonstrated that standards can encourage innovation when they result in clearly defined areas, such as the layers in a stack, because software entrepreneurs are well aware that developing 'pluggable' software solutions is an opportunity to enter a global market.

By emulating the computer industry, the shipping sector should be able to drive positive change in a world of increasing climate-induced natural disasters and massive supply chain disruptions by releasing a new wave of unprecedented innovation. **SN**

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