

# Process completeness for effective maritime ecosystems

by

Mikael Lind,<sup>1,3</sup> Richard T. Watson,<sup>1,2</sup> Michael Bergmann,<sup>1</sup>  
Robert Ward,<sup>1</sup> Niels Bjørn-Andersen,<sup>1</sup> Sandra Haraldson,<sup>1</sup>  
Michael Rosemann,<sup>1,4</sup> Trond Andersen<sup>1,5</sup>, Nik Delmeire<sup>6</sup>

<sup>1</sup>RISE Viktoria, Sweden, <sup>2</sup>University of Georgia, USA, <sup>3</sup>Chalmers University of Technology, Sweden,  
<sup>4</sup>Queensland University of Technology, Australia, <sup>5</sup>Port of Stavanger, <sup>6</sup>European Shippers' Council

## Introduction: Focused competency is core to success

When Henry Ford operated the Ford Motor Company, he felt a need to have absolute control of nearly all aspects of his supply chain in order to produce cars. As a result, he owned Brazilian plantations to supply the rubber for the tyres he made for his autos. Such operational breadth requires diverse managerial skills and knowledge, including how to manage a rubber plantation in a distant country. As the world has become more complex, companies have learned that it is often better to focus on core competencies in order to achieve world-class effectiveness. The rest is sourced from suppliers. Today, Ford concentrates on the design, assembly, and marketing of its cars. Multiple suppliers provide many components and supporting services needed for final assembly. Another example from the auto industry is in the relatively new 22,000 employee Bratislava plant, where VW has outsourced the detailed handling of supplying spare parts for its assembly lines to 800 DHL employees, "*due to DHL's innovative concepts and a supply chain solution tailored exactly to VW needs*"<sup>1</sup>. This is often referred to Value added Logistics (VAL), where transportation/shipping is a necessary part.

For Ford and for VW, VAL is not a core competency or a corporate function. Shipping and delivery are services they prefer to delegate to an efficient and reliable single supplier. Over the last more than 30 years many organisations in manufacturing have moved from handling everything internally in their hierarchy to orchestrating the market to provide required services. However, this puts extra requirements upon

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<sup>1</sup> Juraj Janá, Head of Logistics with Volkswagen in Bratislava

each provider throughout the transport chain, such as shipping companies, ports with their conglomerate of service providers, and hinterland operators.

In this short concept note, the notion of *process completeness* is proposed as a way to identify the requirements of transport hubs, such as seaports, in order to enable inter-operability and higher effectiveness in the supply chain.<sup>2</sup> As such, transport is seen as an integrated process in which different parties (manufacturers, traders, shipping lines, land transport providers, ports, etc...) have to effectively and efficiently collaborate effectively and efficiently in order to provide excellent service.

### **The service imperative**

By enabling customers to move goods between two points, shipping lines and all other parties mentioned previously provide a critical service to the global economy. Thus, customer service is a key source of competitive advantage for many organizations, and in order to develop a customer service strategy, transport companies need to understand what their customers want and how they provide the service components to the overall experience. As such *process completeness* is a fundamental objective for meeting customers' needs.

*Process completeness* occurs when the service delivered meets the customers' expectations and the required service resources are deployed efficiently and effectively. Failure of the service delivery process to meet customers' expectations can be due to either process under-completeness or over-completeness.

*Process under-completeness* occurs when an under-investment in resources results in an inability to meet customers' expectations. The failure to satisfactorily fulfil a customer's needs creates a *service gap*. For example, the lack of sufficient capacity in the maritime transport process leads to bottlenecks and subsequent waiting time that, to the customer, is a service gap. Likewise, a customer who has to individually contract and coordinate with multiple members of a transport network will perceive another service gap (the lack of orchestration).

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<sup>2</sup> Lind M., Watson R.T., Bergmann M., Ward R., Andersen N-B., Jensen T., Haraldson S., Zerem A., Rosemann M. (2018) Digitizing the maritime eco-system - Improving door-to-door coordination via a digitized transport chain, Concept note #11, STM Validation project

Conversely, *process over-completeness* occurs when there is an over-investment in resources leading to a capacity and capability that customers neither need nor expect. This could be when assets sit idle for a substantial amount of time.

Process completeness therefore means (just-in-time) synchronisation of service capacities with the required demand, so that there are minimal waiting or idle times.

Hence, process completeness in the transport eco-system will have occurred when a single agent manages and coordinates the set of transport services needed to deliver end-to-end customer service. For example, a product transported between two points might require multiple services from road, rail, and shipping as it moves from hub to hub on its journey from manufacturer to final consumers. While each of these economic entities/actors may view themselves as independent service providers, customers generally prefer a single complete service. They prefer to source the complete process from one entity who carries the overall responsibility for the orchestration of all related process steps, so that they can avoid the complexity and knowledge required to deal with a complex transport ecosystem.

Accordingly, every actor in the transport service chain needs to recognize that they have a key role in delivering end-to-end customer services as a common object of interest (goal).<sup>3</sup> This means that they need to be mindful that in attempting to optimize their individual performance (the local optimum) they do not compromise process completeness for the entire chain, i.e. the global optimum.

The transport process network provides services to a range of customers, including shipping companies (which could be charterers), cargo shippers, cargo owners, and cargo receivers.<sup>2</sup> There can also be actors combining several of the services. For example, a shipping company that also offers a range of services to its customers (cargo owners, shippers etc.). Another example is a shipping line receiving services from various entities within a port, such as towage, bunkering, cargo operations, and waste management. A further example is rail and trucking companies who also provide transport services to the senders and receivers of goods as part of a total transport process network.

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<sup>3</sup> Haraldson S. (2015) Digitalization of Sea Transports – Enabling Sustainable Multi-Modal Transports, Twenty-first Americas Conference on Information Systems, Puerto Rico, 2015

Achieving process completeness is dependent upon each of the service providers meeting previously agreed targets and expectations and responding with agility when adjustments are necessary. For example, in the shipping context, pilots, tug operators and berths must be ready when expected, and terminal operators must unload or load within a planned time-window. It also means that receivers should get their goods on time and both the sender and the receiver are kept fully informed of the progress of a shipment. This is the basis for optimal service provision. Consequently, common situational awareness, based upon upstream plans and progress and downstream capabilities, is important to achieve the balance between process under- and over-completeness. To do this, expectations must be met by all the actors in the various transport modes in the network between a sender and a receiver of goods. The definition and careful monitoring of mutually signed service level agreements at critical touch-points along a transport process helps to embed process completeness.

It is most likely that transport networks will struggle to meet process completeness when there are many interfaces and actors in the delivery chain and when there is inadequate investment in data exchange to enable the levels of coordination necessary to ensure seamless transitions between modes, such as vessel to road and/or rail. For process completeness, there must be process and data integration within and across the service providers. Additionally, because hub facilities are frequently co-utilized, cooperative scheduling and the use of established procedures for quickly arbitrating conflicting resource requests are essential for hub level process completeness and in turn for achieving the overall process integration in the transport ecosystem.

As illustrated in Figure 1, from the customer's perspective, there are four distinct options to achieving process completeness: functional completeness, firm completeness, static multi-firm completeness, and dynamic multi-firm completeness.

*Functional completeness* when one department or functional area within an enterprise completely fulfils a customer's service needs. The customer deals with only one contact point for all aspects of a process, such as a door-to-door shipment. For customers, this is the ideal situation. VW's use of DHL to handle inbound logistics (including unpacking and bringing all parts to the correct place on the assembly line) for its Bratislava plant is a powerful example of functional completeness. This means that the department / functional area becomes the orchestrator for the realization of the customer demands.

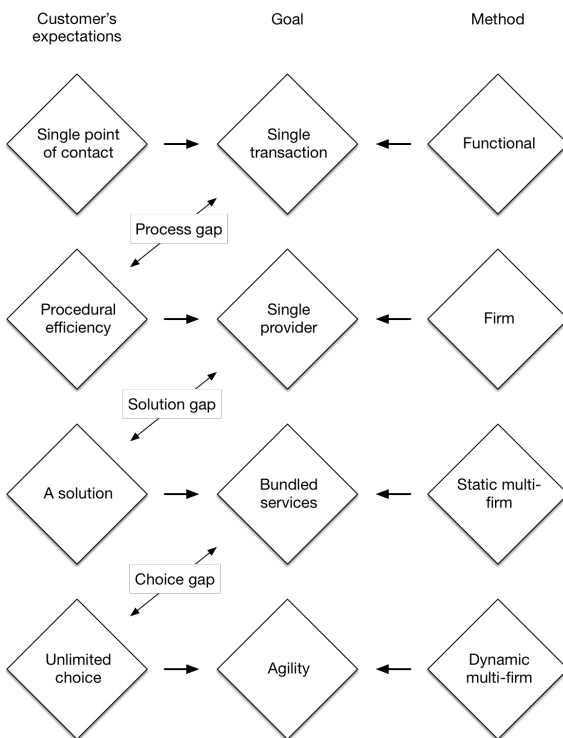


Figure 1: Process completeness options

*Firm completeness* is necessary when a customer's needs span multiple functional areas within the same firm and the customer must deal separately with each of these functional areas. For example, the customer might have to deal with the trucking and shipping divisions of a multi-modal firm. However, when there are several service providers, the service might not be completely seamless, and the customer has to resolve them or live with procedural inefficiencies. For example, the physical transition from trucking to shipping might work smoothly, but if the divisional information systems of the trucking and rail divisions are fragmented or incompatible (which often happens after mergers and acquisitions), then important and up-to-date data on progress can be lost or be difficult to access.

For example, the Maersk shipping group, constantly face the unwieldy task of trying to digitally integrate or at least enable seamless digital necessary data exchange for a range of different systems operated by the freight forwarders and the terminal operators in different geographical locations, container shipping lines, etc. Furthermore, on top of this comes the desire for digital integration with suppliers and customers.

*Static multi-firm* completeness occurs when a group of transport network companies create an alliance to solve a customer's need but continue to operate as independent units. Thus, a shipping and a trucking company might establish a partnership to provide physical door-to-door delivery between selected major cities on a daily basis, but if their information systems are not integrated, then the customer will likely have to deal with multiple points of contact. Another example of a deficiency in process completeness is when you book a ticket with airline A and are offered a discount with hotel chain B in your destination city but then discover that you have to re-enter your travel details into the hotel's information system. This is a rudimentary attempt at process completeness that

many customers will find cumbersome because it does not deliver the expected level of integration.

*Dynamic multi-firm* completeness is necessary when the changing and diverse needs of customers requires agility in the use of a network of service providers. An engineering company serving many customers across multiple countries might find that its needs vary depending upon the size of the product to be shipped and its destination. As a result, the engineering firm might need to employ different transport networks and different contracts for its deliveries. Accordingly, the engineering company needs to have expertise in a non-core area, unless it is possible to find a third party logistics service provider with a single point of contact, capable of handling all transport needs.

The different types of process completeness also apply to each individual transport provider, such as a ship, where the unit of focus determines the level of process completeness. If a ship treats a port visit as its unit of focus, process completeness should most likely involve a single contact point for all the services related to the port, which is functional completeness, because a port visit is the ship's purpose (the purpose of call). To support such a single point of contact arrangement for port activities, the Port Collaborative Decision Making (PortCDM) concept, as developed within Sea Traffic Management (STM), is intended to provide a holistic perspective to enable the efficient conduct of the sea transport process. On the lowest level, PortCDM<sup>4</sup> can help achieve functional completeness by providing the data necessary to support process completeness by a single entity coordinating the services all actors involved in a port visit.

However, many customers face static or dynamic multi-firm incompleteness because a voyage is their unit of focus, and a voyage, or several voyages in sequence, might require them to deal with multiple ports, customs authorities and so forth. Corporations (such as a shipping company) tend to be centred on a specific service as opposed to an end-to-end customer experience. The adoption of PortCDM across multiple ports will contribute to improving process completeness for a voyage or a sequence of voyages as it provides an integrated data platform enabling port-to-port communication and increased

coordination possibilities.<sup>4</sup> Although this is a huge step forward, two conditions need to be met:

1. There must be a single agent with overall orchestration responsibility and the capability to achieve process completeness.
2. Every individual actor in the complete transport eco-system must as a minimum
  - a. Implement the digital messaging standard for all involved transport modes (such as STM standards for sea transports) for every communication
  - b. Every actor must provide accurate times for intentions and outcomes to support the coordination and optimization of the overall transport ecosystem, including port visit and voyage optimization.

We can gain further insights into process completeness by examining the different gaps identified in figure 1.

### **Closing the gaps**

The absence of predefined options or choices for arranging the shipping of goods is the worst situation for customers as they become responsible for (1) putting together the various processes, (2) managing the coordination to ensure process completeness, and (3) handling the various modes of transport, including the handling of paperwork such as customs clearances.

An alliance solves the choice gap as it can provide an integrated service, but as long as the alliance members continue to operate as separate economic entities, especially with respect to information systems, the customer still has to manage data integration. We can think of a port as a loosely connected alliance of services, but loose linkages result in a lack of integration and the customer loses out on procedural efficiency.

Coordinated physical and informational integration can close the process gap so that the customer has only one point of contact. A port visit or the shipping of goods becomes a single transaction with seemingly a single entity. In this way, the complexity of integrating the various processes of a ship's visit or of a shipment is handled through a single interface. Behind this interface, data should be shared across information systems

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<sup>4</sup> Lind M., Bergmann M., Haraldson S., Watson R.T., Michaelides M., Herodotou H., Voskarides S. (2018) Port-2-Port Communication Enabling Short Sea Shipping: Cyprus and the East Mediterranean, Concept note #5, STM Validation Project

through standardized message exchanges so that the customer sees the complete picture of each stage of the process (as promoted by the S-211 standard<sup>5</sup>). In a perfect world, this complete picture should be based on a shared common situational awareness among the actors involved in providing services to customers.

### **Moving forward on process completeness**

Accordingly, the choice gaps experienced in the transportation process need to be analysed and understood in order to devise appropriate process completeness strategies in the full transport ecosystem.

Elimination of the gaps can then be approached by designing a service system that will meet expressed and emerging needs. This will inevitably lead to an open system that can be dynamically expanded as required. The major challenge is to develop multimodal data exchange standards that enable all service providers to reliably exchange relevant data. This enables behind-the-scenes data exchange that permits customers to use a single interface to dynamically create a tailored collection of linked services. Imagine an interface where customers can sequence services using a drag-and-drop menu interface, in order to define process completeness and that the nominated parties subsequently execute the services seamlessly. To do this, the delivery of these compound services needs to be coordinated among the involved service providers. For example, a shipping company might have an on-board application with the digital capabilities to provide situational awareness for a forthcoming port call and to order all required port services.

The first stage is to close the choice gap for customers by creating a directory of electronic services that enables a customer or its agent to configure a process chain. Within the maritime sector, the maritime connectivity platform<sup>6</sup> is an initiative to enable a repertoire of possible maritime services for enhanced safety, efficiency, and environmental sustainability for a berth-to-berth sea voyage. Then the solution gap can be closed by standardized message exchange across the relevant providers. Finally, the

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<sup>5</sup> Lind M., Bergmann M., Watson R.T., Haraldson S., Park J., Gimenez J., Andersen T., Voorspuij J. (2018) Towards Unified Port Communications – from a project format to a global standard, Concept note #9, STM Validation Project

<sup>6</sup> Lind M., Bergmann M., Watson R.T., Haraldson S., Park J., Christensen T. (2018) From concept to implementation - an interplay between research and practice, Concept note #7, STM Validation project



process gap can be collapsed through creating and managing process completeness as a whole rather than as a series of separate events. PortCDM is aimed at facilitating this collapse through the distribution of relevant data to continuously provide up-to-date situational awareness of the status of each of the events required to deliver an end-to-end customer service.

### **An example of process completeness**

Process completeness is a customer-centric view of service distribution. It emphasises the totality of the customer's expectations and the goal of a single transaction that embraces all the customer's needs. In the shipping industry, the cruise lines are closest to achieving process completeness<sup>7</sup> because they practice delivering a full-service experience, which on top of port-to-port operations includes flying the customer to the point of embarkation, providing onshore excursions, and flying the customer home from the discharge point. As choices multiply and complexity increases, successful process completeness can become a winning strategy.

Disney, a world leader in family entertainment, demonstrated its appreciation of process completeness about five years ago when, in further support of the services already described, it introduced the MagicBand, a one-billion dollar investment. In advance of a visit to Disney World guests are sent their MagicBand, which contains an RFID chip that can be used:

- to check in to a Disney resort
- to check in to Disney's Magical Express upon arrival.
- to unlock the guest's hotel room
- to enter theme parks, if admission tickets are linked to the guest's account.
- to access a resort's amenities, pool & laundry areas
- to use Disney Dining Plan credits, if the guest has purchased a Disney Dining Plan.
- to charge purchases to the guest's room, if linked to a credit card and a pre-established PIN.

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<sup>7</sup> Lind M., Andersen T., Bergmann M., Watson R.T., Haraldson S., Rygh T., Karlsson M., Kinn M. (2018) Coordinated value creation in Cruise Call Operations – The case of Port of Stavanger, Concept note #10, STM Validation project

Another example of movement towards the process completeness concept is the current move in the automotive industry from selling cars to offering mobility-as-a-service. Whereas selling a car used to be the end of the sales relationship, it increasingly is the beginning of a relationship. Orchestrating all services required for mobility requires sourcing way-finding, parking, fuelling, maintenance, drive-home, insurance and other services so that the customer experiences a complete service from one provider. For the maritime sector this would mean moving from offering a particular service along the transport process to end-to-end shipping as a service.

### **PortCDM for achieving process completeness**

The transport process network is a sharing economy, where the network's resources are co-utilized by many parties. Indeed, we assert that the maritime industry pioneered the sharing economy centuries ago. Transport hubs, such as ports, are designed to enable many parties to use their facilities and services. Thus, they need to accommodate a wide variety of customers. To make efficient use of available resources, each hub might develop common procedures for operations within the hub, but these are likely to differ across hubs. The lack of standards impedes process completeness because it adds complexity to door-to-door operations.

PortCDM, as an enabler of the Sea Traffic Management (STM) concept, supports collaborative decision-making in a hub through standardized messaging (such as S-211). PortCDM with enhanced capabilities could manage resources to support maritime operations as a part of efficient integrated transport operations between modes. For many ports in the world, most of their income comes from providing infrastructure resources for rapid inter-modal shifting so high levels of integration can be a compelling offer.

The introduction of PortCDM (1) recognizes that customers seek process completeness for each shipment through a single transaction with a single entity as part of the entire door-to-door movement of people or goods, and (2) acknowledges that standards improve the efficiency of the co-utilization of resources. The introduction of containers in the maritime industries was an essential step towards co-utilization efficiency.<sup>8</sup> A

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<sup>8</sup> Watson, Lind, & Haraldson. (2017). *Physical and digital innovation in shipping: seeding, standardizing, and sequencing*. Paper presented at the HICSS. <https://scholarspace.manoa.hawaii.edu/handle/10125/41741>

containerized cargo can be efficiently transported from one transport mode to another. We now need a 'containerization' of processes and data exchange to facilitate higher levels of efficiency. Containers solved a physical problem. Digitization is the path towards solving digital process and data integration problems across all hubs.

PortCDM is not tied to a single physical hub. It highlights that collaborative decision-making, as seen in AirportCDM, is required as an enabler of (sea)port performance as part of the entire transport network to achieve process completeness and higher levels of resource co-utilization. Furthermore, PortCDM will need to embrace AI and machine learning in order to bring efficiency to complex dynamic resource co-utilization within ports. Land transport sharing services rely on road navigation systems for route efficiency. Similarly, co-utilization across cargo sharing services will rely on information systems to handle cargo processing through the complete land, sea, and air transport network. Support systems will help a shipping agent, or similar entity, construct a process completeness chain and then execute the movement of cargo through this chain while keeping all concerned stakeholders fully informed of progress.

Inter-connected hubs are the physical necessity for providing the door-to-door service required for process completeness. PortCDM is the informational necessity for ports to contribute to process completion. PortCDM has some common features across all (sea)hubs, specific features for such a class of hub, and local characteristics for a particular instance. PortCDM must enable each of a hub's actors to contribute to overall process completeness through the integrated co-utilization of resources.

### **Final words: The path to process completeness**

Meeting customers' process completeness expectations is a challenging target that needs to be addressed from both a hub and network perspective. Firstly, hubs could create a service centre that bundles hub services into a single offering. Thereafter, standardization of hub services could proceed to the point where the services required for a voyage or trip could be bundled into a single offering. Such bundling would most likely initially occur for a regularly scheduled service between two hubs, for example, the ferry service between Gothenburg and Frederikshavn. Beginning with process

completeness between two hubs would be a first step towards creating process completeness across networks and for voyages.

Digitization is a prerequisite for achieving a better coordination in the full shipping transportation process. However, digital innovation is a means not an end. In this concept note, process completeness is identified as an enduring customer goal, with a number of paths to its accomplishment, including digitization, standardization, AI, and service bundling. The key to success in every business is a clear understanding of customers' needs, and this is no less so in the transport industry. We suggest that process completeness via transparent and well-synchronized cooperation among involved actors and in particular the sharing of relevant data by the use of PortCDM is critical to increased efficiency and effectiveness in the movement of goods and people, especially when the sector provides a very substantial component.

***For more information, contact:***

Mikael Lind, Activity Leader PortCDM testbeds, RISE Viktoria, +46 705 66 40 97 or [Mikael.Lind@ri.se](mailto:Mikael.Lind@ri.se)

Sandra Haraldson, Activity Leader PortCDM testbeds, RISE Viktoria, +46 707 61 88 14 or [Sandra.Haraldson@ri.se](mailto:Sandra.Haraldson@ri.se)

Ulf Siwe, Communications Manager, Swedish Maritime Administration, +46 10 478 56 29, or [Ulf.Siwe@sjofartsverket.se](mailto:Ulf.Siwe@sjofartsverket.se)

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