Offshore Wind Logistics brief report 1

- Defining logistics in offshore wind

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This *Offshore Wind Logistics brief report 1* is part of a series of brief industry-focused reports on the key conclusions from the global wind energy shipping and logistics PhD research project. The reports have been crafted by the Panticon team during the months of January through August 2019 in order to crystalize the main findings from the academic research project in a non-academic language and style which would support industry in implementing the key changes proposed as a result of the PhD research project. The report has been created primarily based on the PhD research project output, i.e. the PhD thesis and the academic publications produced by Thomas Poulsen during the PhD research project. Where necessary, additional data sources have been utilized as well in order to ensure that the findings are relevant and up-to-date (see Reference section).

The report contains forward-looking statements, which by their very nature, address matters that are, to different degrees, uncertain as they pertain to the future. These, or any other uncertainties, may cause the actual future results to be materially different than those expressed in the forward-looking statements as contained within this report. At Panticon we do not undertake to update our forward-looking statements, nor do we assume any liability for actions or dispositions made by firms, organizations, and/or individuals based on information contained in this report.

Panticon is particularly strong in the Offshore Wind and Logistics sectors within the three core disciplines of Strategic Management Advisory, Mergers & Acquisitions, and Market Intelligence.

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1. Introduction

This *Offshore Wind Logistics brief report 1* is the first in a series of eight short industry-focused reports.

The goal of the brief reports is to make the latest academic research in the market for logistics within the global offshore wind industry more accessible and usable for a wide range of constituencies on a global basis. The brief reports can be read consecutively or individually.

This first report in the series concentrates on "logistics" as a term and starts by briefly outlining the evolution of the definition of logistics from other industries. Subsequently, this report unbundles the complexity of logistics in offshore wind by providing a definition of offshore wind logistics, showing how the definition is created, and explaining why the definition is useful. When understood, the definition of logistics in offshore wind will enable the reader to understand the scale and scope of logistics across the life-cycles of an offshore wind farm.

2. Evolution of logistics terminology in industry in general

The generic definition of logistics in established industries has evolved over the years. This is illustrated in the United States of America (USA), home to the largest group of organized logistics and supply chain management industry practitioners in the world.

In 1963, the *National Council of Physical Distribution Management* was founded in the USA. The purpose was to reflect the shift from freight transportation by rail to freight transportation by truck and the resulting need for warehousing as well as material handling. Since then, the name of the organization has been changed twice. In 1985, it was renamed the *Council of Logistics Management* to include "the integration of inbound, outbound and reverse flows of products, services, and related information." Twenty years later, the *Council of Logistics Management* was renamed the *Council of Supply Chain Management Professionals* to reflect growing complexity of global supply chains.

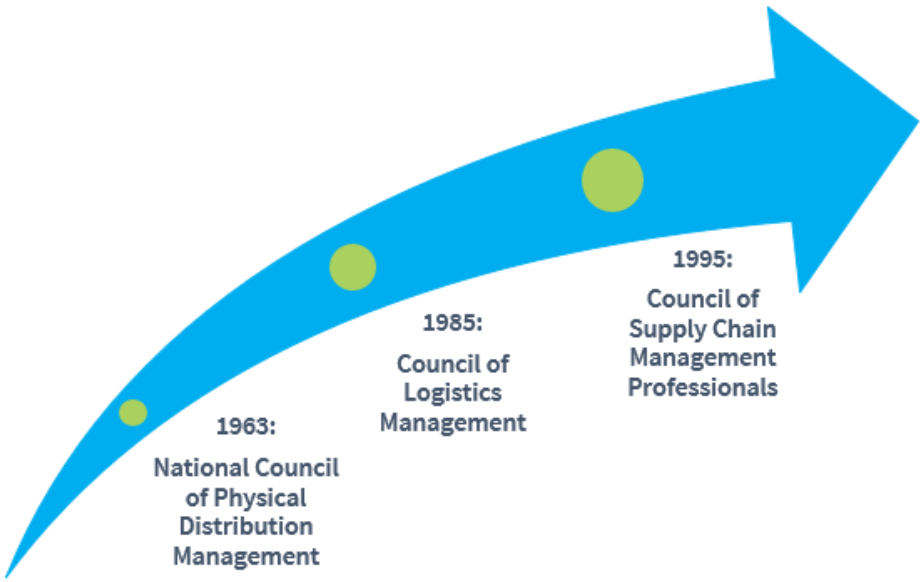


Figure 1: Historical development of the definition of logistics in the USA

The *Council of Logistics Management's* original definition of '**logistics**' from 1991 stated:

> "Logistics is the process of planning, implementing and controlling the efficient, effective flow and storage of raw materials, in-process inventory, finished goods, services, and related information from point of origin to point of consumption (including inbound, outbound, internal, and external movements) for the purpose of conforming to customer requirements."

Today, the *Council of Supply Chain Management Professionals'* definition of **supply chain management** states:

> "Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies."

Furthermore, the organization defines **logistics management** as:

> "…that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverseflow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements."

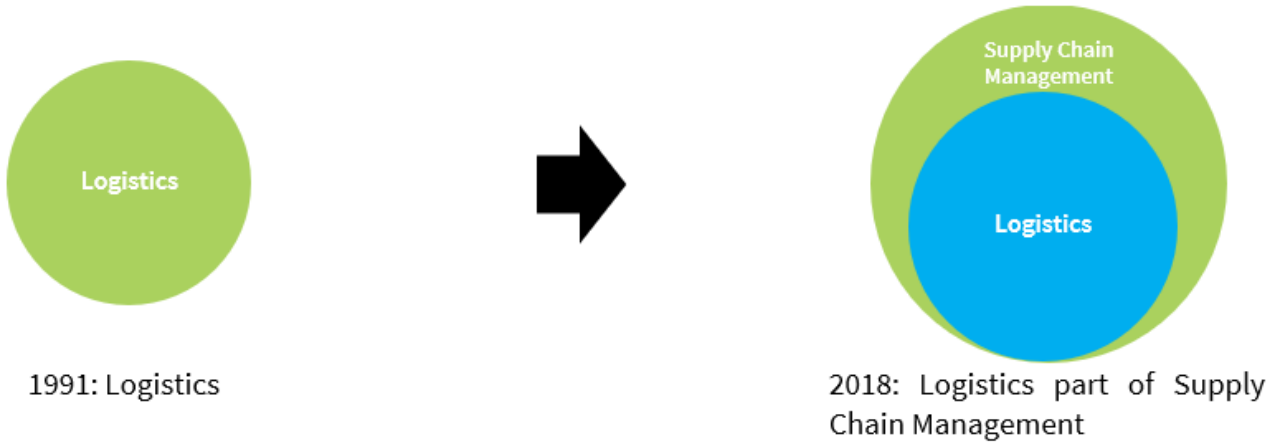
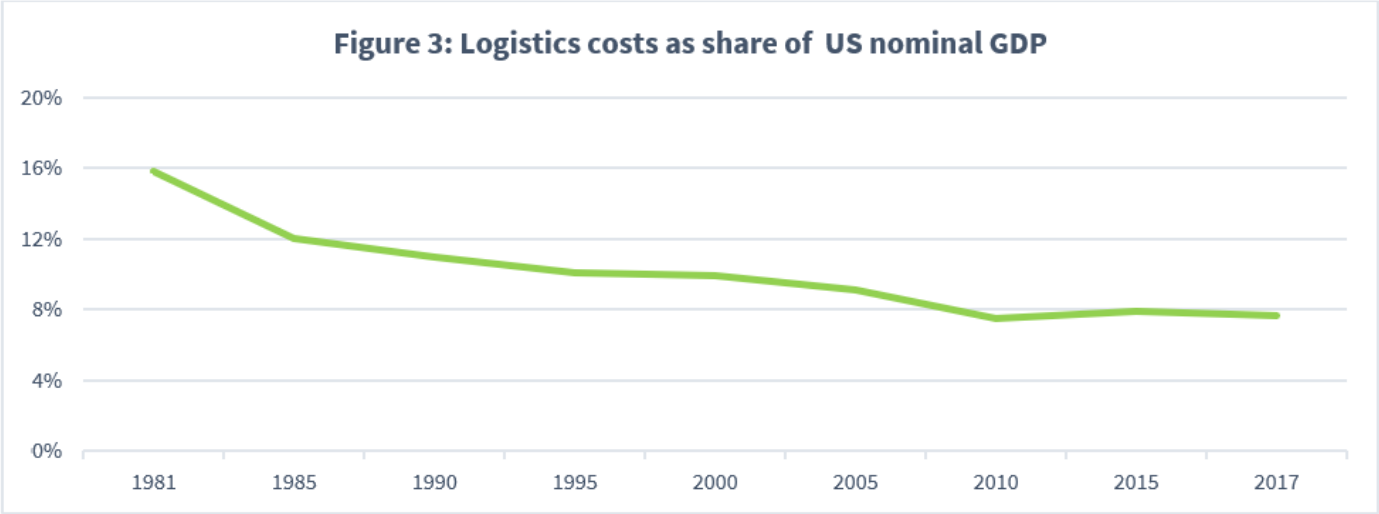


Figure 2: Historical development of the definition of logistics in the US

In its annual reports, the *Council of Supply Chain Management Professionals* highlights the economic importance of logistics via various metrics. One such metric compares logistics costs in the USA as a share of the country's gross domestic product (GDP). Figure 3 below shows the metric for the period 1981 through to 2017 which has dropped by more than half.



Source: CSMP's Annual State of Logistics Reports, 2014 & 2018

A similar metric for the offshore wind industry would be useful to measure cost reduction from a logistics angle. Within offshore wind, levelized cost of energy is often used as the key means of understanding the total cost of an offshore wind farm from "cradle-to-grave" seen in relation to the energy output generated. As such, levelized cost of energy can be used across different energy forms to compare cost. Over time, the resulting efficiencies, improvements, and innovation translate into lower costs. Differences in costs will exist per life-cycle phase within the lifespan of an offshore wind farm. At the same time, costs will vary in different regions of the world as well as in individual countries.

3. Offshore wind logistics defined

To be able to reduce logistics cost in the offshore wind industry, a clear definition of offshore wind logistics is needed. However, mainly because the offshore wind industry is relatively young and still evolving at a fast pace, the definition of offshore wind logistics has not previously been clear cut and a key research outcome was that logistics has now been defined in the offshore wind industry:

> **"Parts, modules, components, people, consumables, and tools are responsibly stored and moved safely, weather permitting, onshore, as well as offshore by air/ocean/land using various transportation assets and transport equipment with a focus on an individual wind turbine generator, an offshore wind farm asset project, or across a portfolio of projects by means of different in-house and outsourced logistics skills/capabilities/IT systems used across multiple supply chains spanning different starting and ending points, also duly considering inventory carrying costs."**

The definition is complex and extensive. This is mainly because it is crafted along 11 different dimensions. Table 1 depicts the definition of offshore wind logistics across 11 dimensions.

Dimensions	Parts of definition
1. What	*"Parts, modules, components, people, consumables, and tools*
2. Health, Safety, Security, Environment & Quality	*are responsibly stored and moved safely,*
3. Weather	*weather permitting,*
4. End to End (E2E)	*onshore, as well as offshore*
5. Modes	*by air/ocean/land*
6. How	*using various transportation assets and transport equipment*
7. Focus	*with a focus on an individual wind turbine generator, an offshore wind farm asset project, or across a portfolio of projects*
8. Competencies	*by means of different in-house and outsourced logistics skills/capabilities/IT systems*
9. Multiple Supply chains	*used across multiple supply chains*
10. Start/End	*spanning different starting and ending points,*
11. Inventory carrying costs	*also duly considering inventory carrying costs."*

Table 1: Definition of offshore wind logistics

4. The 11 dimensions of the definition of offshore wind logistics and the fit into the offshore wind farm lifecycle

There is increased pressure to reduce the levelized cost of energy of offshore wind farms across the entire offshore wind value chain. Key factors driving this trend include:

- Competition with other power generation technologies – both fossil and non-fossil fuel based
- Increased competition as more suppliers enter the offshore wind industry
- Decline in government subsidies as support schemes shift from feed-in-tariffs to auction systems

An offshore wind farm's lifespan can be divided into four **life-cycle phases**, and corresponding **supply chains**, as shown in Table 2 below.

Offshore wind farm life-cycle phase	Development & Consent (D&C)	Installation & Commissioning (I&C)		Operations & Maintenance (O&M)		De-commissioning (De-comm)
Supply chain	D&C chain	I&C chain - Inbound	I&C chain - Outbound	O&M scheduled	O&M unscheduled	De-comm chain
Description (logistics focused)	Site surveys, birds, wildlife, sea, seabed	Inbound assembly parts and components	Outbound wind modules for wind farm site	Personnel, parts, and components	Personnel, parts, components, and modules	Restoration of site for new wind farm or to original condition
Characteristics (logistics focused)	Specialized vehicles (onshore) and vessels (offshore)	Mainly a homogenous flow using sea containers and air; some project cargo	Project cargo / breakbulk	Mainly service boats, crew transfer vessels and some larger vessels	Service boats and helicopters, some larger vessels like MPV, tug & barge, WTIV	Project cargo / breakbulk

Table 2: The four offshore wind farm life-cycle phases and corresponding supply chains

Dimension 1: What/Who

"Parts, modules, components, people, consumables, and tools…"

- Wind turbine components, balance of plant components, technicians, provisions, tools, personal protection equipment, and spare parts

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 2: Health, Safety, Security, Environment & Quality (HSSEQ)

"… are responsibly stored and moved safely, …"

- Considerations about health and safety of people, the overall project and personnel security, environmental considerations, and quality of work rendered

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 3: Weather

"… weather permitting…"

- Wind, waves, currents, visibility, and general weather condition

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 4: End to End (E2E)

"…onshore, as well as offshore …"

- All logistics tasks, both onshore and offshore, across the entire lifespan of an offshore wind farm

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 5: Modes of transport

"… whether by air, sea or land transport…"

- Increasingly sea transport as wind turbine size increases and component manufacturing sites shift to sea ports, i.e., for the installation and commissioning supply chains
- Increasingly air transport as offshore wind farms move farther offshore, i.e. for the operations and maintenance supply chains

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 6: How

"…using various transportation assets and transport equipment …"

- Means of transport such as truck, ship, boat, vessel, or helicopter
- See dimension 5 above

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 7: Focus

"… with a focus on an individual wind turbine generator, an offshore wind farm asset project, or across a portfolio of projects …"

- Whether the focus of the logistics task at hand is:

  an individual wind turbine, e.g., break-down maintenance

  an entire offshore wind farm, e.g., during installation or in the event of a cable disruption during operations

  across a portfolio of offshore wind farms, e.g., survey vessel operations across more offshore wind farms or synergies in terms of spare part storage for several offshore wind farms

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
	✓	✓	✓	✓	✓

Dimension 8: Competencies

"... by means of different in-house and outsourced logistics skills/capabilities/IT systems ..."

- Skills and knowledge in general of people involved
- Core competences of the companies involved
- Sourcing strategies of offshore wind or other companies involved, e.g. in-house versus outsourced ownership of transport assets and transport equipment

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 9: Multiple supply chains

"... used across multiple supply chains ..."

- Single or multiple supply chains involved

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 10: Start/end

"...spanning different starting and ending points, ..."

- Similar or different start points and end points of logistical chains across different scopes, e.g. from manufacturing site to installation port; port operations, etc

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

Dimension 11: Inventory carrying costs

"... also duly considering inventory carrying costs."

- The costs as share of inventory value incurred by companies involved over a given period to hold and store inventory
- Cost includes capital, storage space, inventory service, inventory risk

Development & Consent chain	Installation & Commissioning chain: Inbound	Installation & Commissioning chain: Outbound	Operations & Maintenance: scheduled	Operations & Maintenance: unscheduled	De-commissioning chain
✓	✓	✓	✓	✓	✓

5. Conclusion

A clear definition of offshore wind logistics is the starting point to reducing offshore wind farm levelized cost of energy from the perspective of logistics. By outlining the definition of offshore wind logistics across 11 dimensions, this *Offshore Wind Logistics brief report 1* is useful to establish a common starting point for discussions about the importance of logistics in offshore wind. The definition of logistics in offshore wind helps existing and potential offshore wind constituencies identify the areas where their competences are strongest as well as dimensions where they need to collaborate or altogether subcontract to other parties. This is especially crucial as the offshore wind market expands in and beyond Europe giving rise to new logistics challenges. Logistics challenges continue to evolve because of size increases of average offshore wind farms, wind turbine capacity, and associated components. In addition, offshore wind farms are increasingly situated in deeper waters and farther from shore which makes logistics operations more complex as well as costly. Finally, increased cost cutting measures are prevalent as countries withdraw subsidies while new regions outside Europe enter the industry and logistics will have to deliver its share of the cost reductions required going forward.

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About Thomas Poulsen

Mr. Poulsen is a seasoned professional who has specialized in crafting strategy coupled with generating both tactical organic and strategic M&A driven growth for companies and organizations, mainly based on his experience in the shipping, transport, logistics, offshore wind, and supply chain industry. During his 30+ years in the business, Mr. Poulsen has lived in 8 countries namely his native Denmark, Indonesia (Jakarta), People's Republic of China (Shanghai), Singapore, Hong Kong (before hand-over to PRC), USA (New Jersey, California, and Florida), UK (London), and the United Arab Emirates (Dubai).

Abstract about Thomas Poulsen's PhD: Logistics in Offshore Wind

The PhD thesis is about offshore wind and focuses on logistics, broadly defined. As such, the research pertains to the offshore wind supply chain from the perspective of transportation and logistics tasks on land, through ports, at sea, and in the air. In addition, the research has dealt with logistics costs seen in relation to levelized cost of energy throughout the entire lifespan of an offshore wind farm project. The research has also dealt with the globalization of the offshore wind market, using China as the main example.

The results of the research have shown that logistics makes up a significant cost item within offshore wind. The results also revealed that it is important to organize logistics in an effective manner within those firms and organizations participating in the offshore wind industry. The eight academic articles which have been published as part of the PhD research project have been framed in the context of strategic management as well as the mergers & acquisition efforts forming part of the offshore wind industry as the market consolidation intensifies.

The research has been conducted in close collaboration with a series of leading offshore wind organizations and companies. The research was funded by Aalborg University and the Danish Maritime Foundation (Den Danske Maritime Fond) through grant number 2012-097.

What we do at Panticon

At Panticon, we are particularly strong in the Offshore Wind and Logistics sectors within our three core disciplines of **Strategic Management Advisory**, **Mergers & Acquisitions**, and **Market Intelligence**. We are mainly focusing on the business side to improve our clients' performance, create value in the long-term, and to create sustainable competitive advantages.

How we create value

- Tailor-made strategies
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- Share knowledge
- Analyse markets
- Advise our clients in every aspect of our three core disciplines

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