



MARITIME TREND REPORT

Observations and perspectives on the future of
the maritime industry

By Danish Ship Finance and Rainmaking



DANISH
SHIP FINANCE

RAINMAKING

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Foreword

This piece of research combines the insights of Rainmaking and Danish Ship Finance. We have partnered to publish a report for the maritime industry, in which we look at current trends through the lens of global startups. These findings are flanked by a 'digital 2030 vision' for the shipping industry, in which Danish Ship Finance presents possible future directions for the industry.

The report is structured in three chapters:

- **Industry innovation** outlines our findings from the global startup scene.
- **Industry transformation** explores how new business models will begin to transform value creation in the shipping industry.
- **Industry redefined** weaves these elements together to formulate how value creation

across the supply chain may be redefined.

Many players within the established global maritime ecosystem are working to digitalise parts of the operation by introducing new technologies to existing business models. We have chosen to look outside the more established part of the industry and have identified 160 startups from the wider global startup scene, in the hope of finding the first hint of new frontiers of digital innovation in the maritime sector. Our conclusion is unequivocal: digital adaptation in the industry is taking off dramatically in 2018.

When we compare the digitalisation journey of the shipping industry with that of other industries that have progressed further, we appear to be close to an inflection point. We expect that the shipping industry's adaptation to new technologies and new business models will intensify strongly within the next five years

– maybe even sooner.

In our digital 2030 vision, we conclude that some of the basic mechanisms for value creation in the shipping industry could be redefined within the next ten to 15 years, even though most of the startups we have analysed are enablers of innovation, rather than disruptors of the traditional maritime players'.

We outline three business models that may have a major impact on the shipping industry: value beyond the vessel, reinventing the operating model and traditional business models. Some of these will play out, while others will be overtaken by alternative scenarios or the status quo will prevail longer than expected. Even so, we urge our readers to consider some of the structural challenges that we believe are transforming the long-term outlook for value creation in many parts of the shipping industry.

INDUSTRY INNOVATION

The introduction of new technologies is causing existing business models to be upgraded. We take a look at the global **startup scene** to understand how the industry may innovate in the years to come.

INDUSTRY TRANSFORMATION

The new business models will begin to transform value creation in the **shipping industry**. The role of the vessel will change and new competitors will emerge.

INDUSTRY REDEFINED

Most of the traditional business models will find it increasingly difficult to compete with ecosystem players who fundamentally **change how value is created** and distributed across the supply chain.

Emergence of structural challenges that may change how value is created in the shipping industry

The transport and logistics industry has been slower to introduce digital innovations than many other industries, which is putting several of the industry's established players' business models at considerable risk. As other industries with close links to logistics, such as retail, is revolutionised by digital technology, the chances of digital disruption engulfing the shipping industry increase. While digitalisation threatens to fundamentally disrupt vital parts of business models, it could also help unlock enormous untapped potential.

THE ROLE OF THE VESSEL WILL CHANGE

We argue that the shipping industry is currently being influenced by a number of leading technologies and trends across sectors that in time will redefine significant parts of the industry. The role of a vessel will change: from being central to value creation to becoming an enabler of additional

streams of revenue. This shift will reflect the introduction of new technologies, and changes in customer behaviour and industry practices.

The emergence of 'digital native' companies has transformed modern industry. Once bound by geography or sector, companies are now leveraging digital technology to build 'borderless entities' – companies that cross over into seemingly unrelated industries and reach global scale in record time. Rather than conforming to traditional industry structures, these companies have created an ecosystem of products and services that fulfil customers' needs globally.

NEW BUSINESS MODELS ARE BEING DEVELOPED

The introduction of new technology in the shipping industry will attract new market entrants and create new expectations among customers, in turn opening up for new

business models. The introduction of digital platforms is one such example, and these are likely to become increasingly important across the logistics industry. Over the next five to ten years, the race to build a dominant global platform will transform the customer's experience of logistics and will be crucial in determining which companies are the winners and losers in a truly digital logistics industry.

An increasingly competitive environment is emerging. New and existing players are finding ways to carve out the more lucrative elements of the value chain by exploiting digital technology and developing new business models. Their aim is to gain control of customer touchpoints and create synergies with their existing businesses. They are forming new entities which, when successfully applied, may be a game changer by redefining the borders of industries, the role of assets and the types of competitor.

SHIPOWNERS DO NOT HAVE AN EXCLUSIVE RUNWAY

The shipping industry is only part of the picture. Shipowners do not have an exclusive runway in the race for future value creation. Multiple players from various industries are investing to obtain a share of the future value. We expect to see an emerging shift in the ownership structure of vessels and profound changes to operating models when ecosystem players move beyond the vessels and integrate across the global supply chain. The vessels themselves will continue to be central to the operation of moving cargo from port to port. But the data they generate will be integrated into the range of services that customers require and begin to drive future value creation far beyond freight rates. Ecosystem players tend to build strong customer bases in one industry, and then move laterally into others to be able to cater for all their customers' needs from origin to destination.

FREIGHT RATES MAY DECOUPLE FROM SUPPLY AND DEMAND

The global supply chain will still require vessels in the future, but their direct contribution to

value creation could be marginalised. Freight rates could decouple both from the supply and demand balance and from vessels' operating expenses. A possible scenario is that freight rates approach zero or stabilise at transaction-based low levels. In the event of this, secondhand prices of vessels will depreciate over time, leaving little room for asset play which currently represents a large part of value creation for many shipowners.

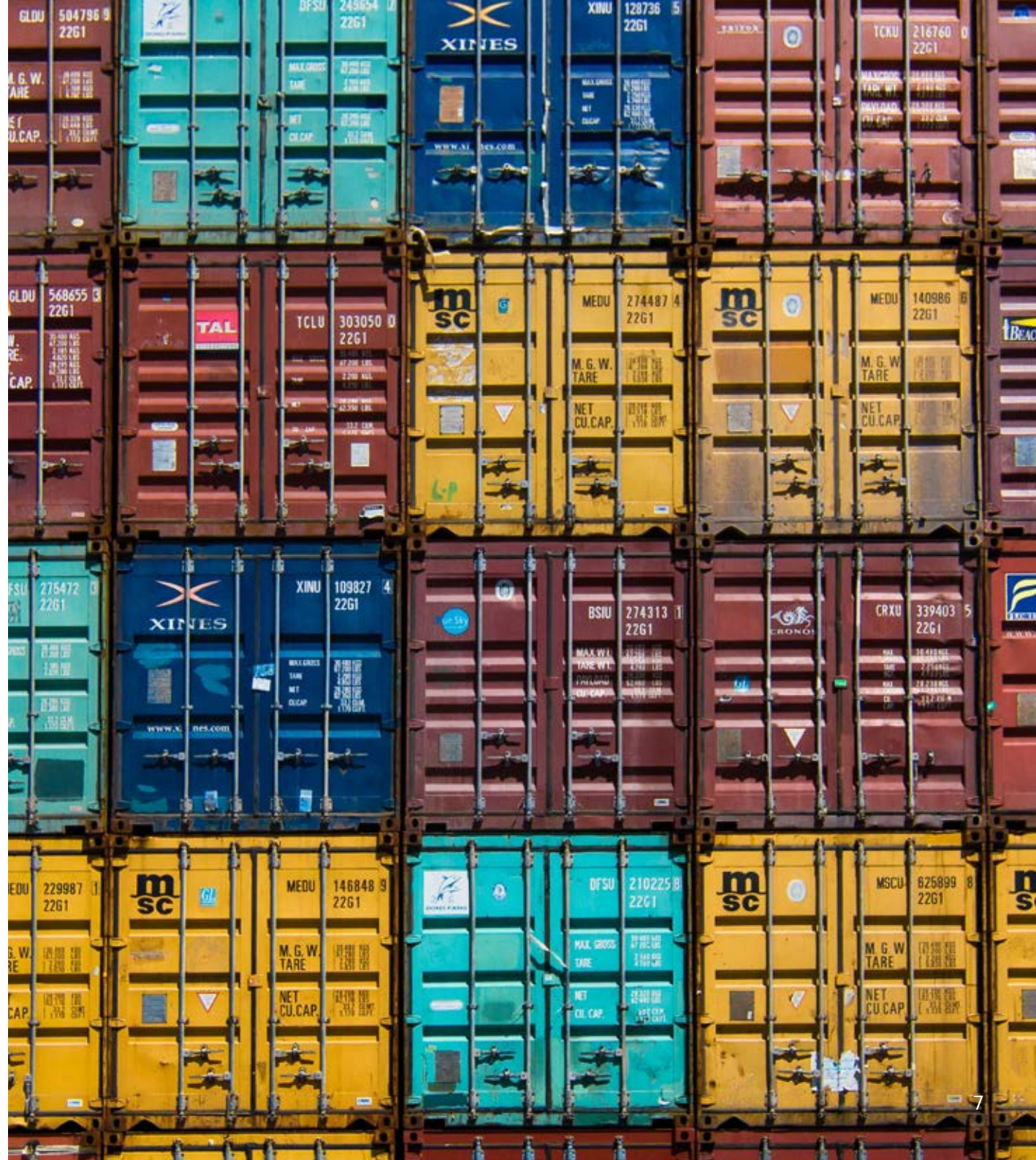
Experience from other industries shows that any industry that becomes digitalised is likely to enter the world of exponential growth and exponential change. Digital information is easy to access, share, and distribute within and across industries. Once something can be represented in ones and zeros – from containerised trade to smart materials – it becomes an information-based technology that can chain react with other technological progressions and disrupt existing industries and business models, as well as unlocking new layers of untapped potential. We argue that the business models of asset owners and ship operators are as likely as those of integrated shipowners (i.e. who run a business where either technical management, commercial management or both are managed internally) to be disrupted, but for very different reasons.

True, we are at an early stage of digital adaptation, but we urge you to consider the following example: When something starts being digitalised, its initial period of growth and change is deceptive, because exponential trends do not increase very fast at first. Let us illustrate the point with a Moore's law example. Starting with a market share of 0.01% and doubling each year, it will take seven years to pass 1% but only another seven to reach 100%. The market changes that are currently emerging are clearly at a very early stage, but this is no reason to conclude that they do not have the potential to be massive within the next decade.

The core services in traditional business models (i.e. transporting goods from port to port) are losing their value in a digital industry, and are being usurped by other services. Vessels will still be needed to perform the task of moving cargo from port to port, but it is the data this generates rather than the cargo that will start to be monetised not only from port to port but through the entire value chain from origin to destination.

The challenge for those continuing to focus on owning assets only is that once something has been digitalised, more people are able to access the information without owning the

asset (e.g. warehouses, ports, vessels, etc.). This constitutes a real problem for traditional players, as we already see new players entering various parts of the global supply chain. These newcomers may start to upgrade specific parts of the supply chain or the entire customer journey without owning a single asset. The separation of data from the asset opens up a wide range of new possibilities in terms of business models and value creation. It will change the borders of industries, the role of assets and introduce new groups of competitors that are not normally considered in this competitive landscape.





TRENDS FROM THE GLOBAL STARTUP SCENE

Industry innovation

A start-up approach to the digital transformation of the shipping industry

Unlocking value via digital adaptation

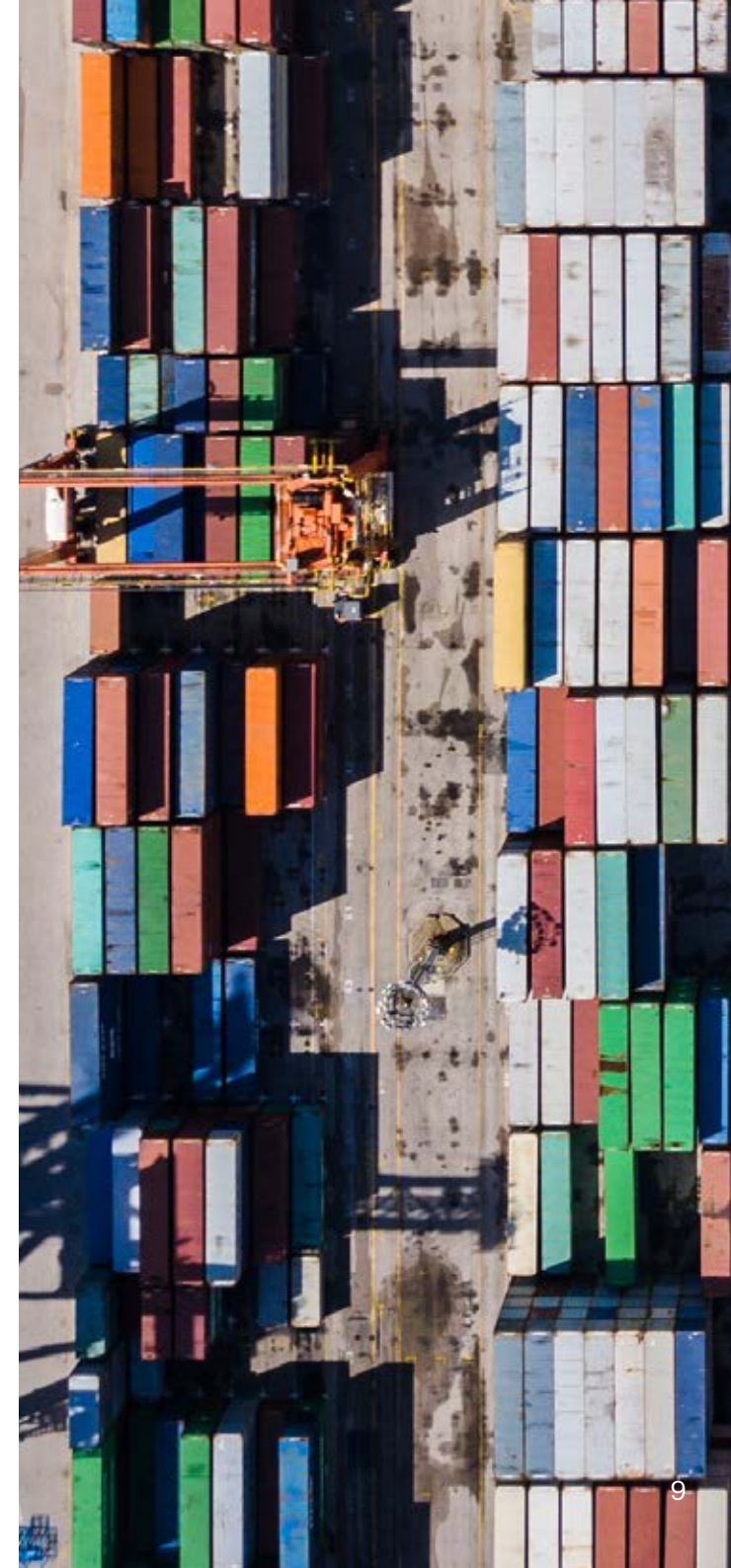
In this report, we discuss the potential transformation of the shipping industry through the lens of global startups. We have chosen this methodology because **startups are founded to meet a need**, a need for which no solution yet exists. Or perhaps one does, maybe in another industry, but it is not sufficiently accessible to those who require it in the current setting. Or it is too costly or too difficult.

Startups identify repeatable and scalable business models. They experiment with new technologies, test and iterate potential solutions that may allow them to orchestrate value creation at a much lower cost than established players. We view startups as a testing ground for viable new business models that can be adopted and scaled up. We can learn from both their successes and their failures.

By following their traction, whether it is in terms of funding or number of customers, we can begin to understand which technologies and business models prove successful in solving which problems. Many of the problems solved in one industry or in one ship segment may be replicated in others.

A great number of startups are already operating in the maritime space, targeting different parts of the value chain. We have looked at the funding stages and the amount of funding received to understand the markets' current assessment of their potential. These findings may tell us what we can expect to happen in the near future.

We have analysed 160 startups based on data gathered in October 2018. As startups move fast, we expect that some information might have changed by the end of the year.



SELECTED CATEGORIES FOR RESEARCH

We take a closer look at the global maritime startup ecosystem to discover how the shipping industry is currently adapting to digital technologies. We focus our research on: performance management, capacity optimisation, value beyond the vessel, and reinventing the operating model.

The four categories may work in sequence or in parallel. The first two identify how the introduction of new technologies can increase the efficiency of the industry, while the remaining two aim to transform the business models of the industry by creating new streams of revenue.

The first two building blocks for the future industry work to identify and commercialise cost and trading leadership. In the early stages, this will enable a competitive advantage. In time, mastering these disciplines will simply become a licence to operate.

The other two building blocks aim to transform and eventually disrupt some of the vital sources of value creation in the industry. When these are successfully commercialised and scaled up, value is

unlikely to be created primarily by shifting cargo. The future ecosystem players may view trade transactions as a low-level entry point through which services can be added, data on transactions and trade flow can be extracted, and value can be created across the global supply chain.

The shipping industry is still in an early phase of digitalisation. And the same goes for startups within the industry. Most of them are, still experimenting with the business model. It is therefore not surprising to see that, at this stage, most of the startups are enablers of innovation through the use of data rather than disruptors of existing business models.

We present our findings from each of the categories on the following pages. In each chapter, we aim to provide an understanding of where the startups are focusing, followed by startup examples. Our choice of startups should not be seen as an endorsement of these, but rather as concrete examples of how technology or business models are being implemented.





PERFORMANCE MANAGEMENT

is about cost savings and improving the performance of the vessel. We look at startups that deal with vessel performance management including fuel and energy management.



CAPACITY OPTIMISATION

is about transparency in the global movement of goods. The aim is to discover and quantify trading opportunities, vessel deployment, cargo routing, repositioning and much more. We look at startups that deal with cargo and vessel tracking and satellite imagery.



VALUE BEYOND THE VESSEL

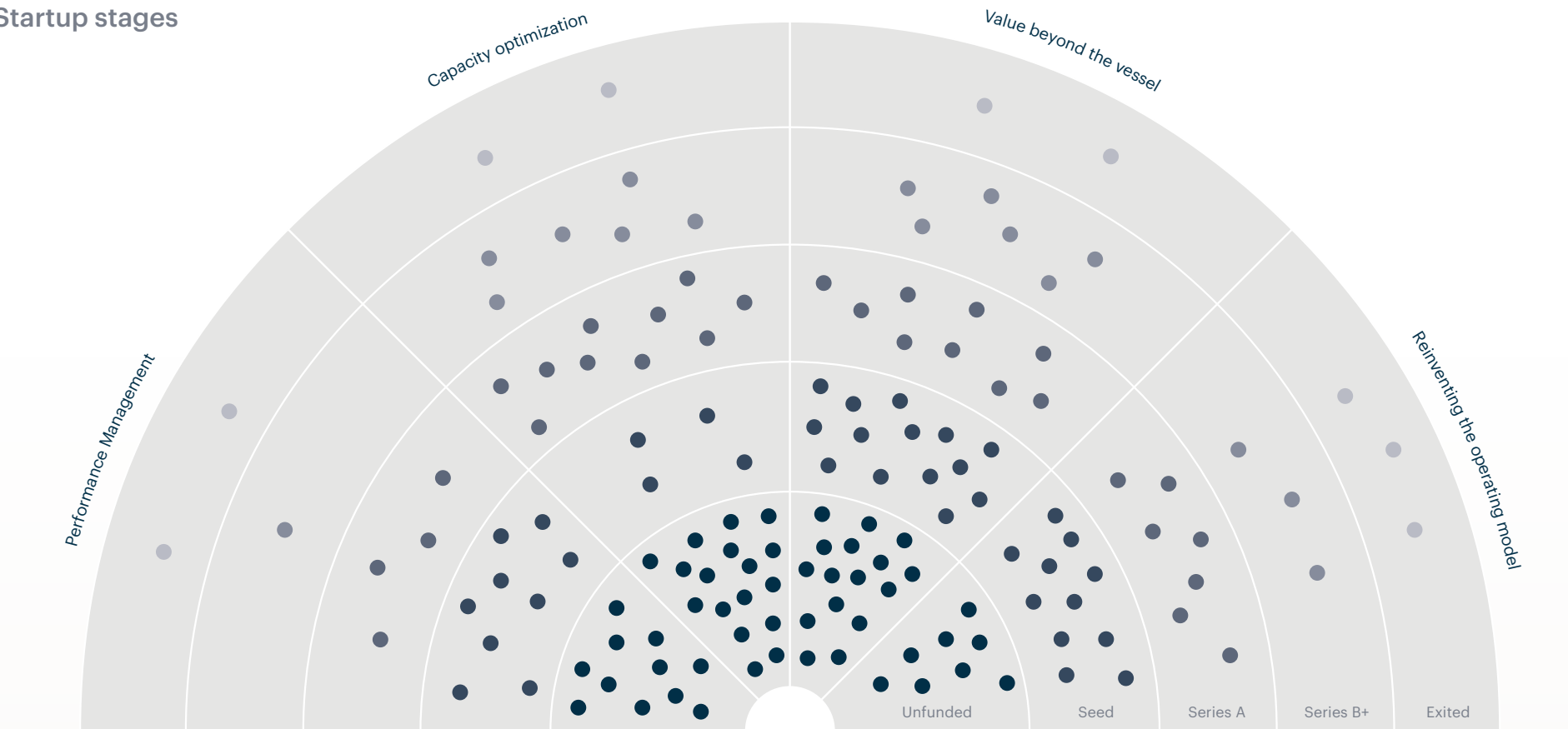
identifies inefficiencies that can be optimised throughout the customer journey from origin to destination. We look at digital freight forwarders, SaaS for freight forwarders, and startups that use the shipping data to predict global trade movements.



REINVENTING THE OPERATING MODEL

is about the focus on end-users, changing the customer journey and allowing the shipping industry to become more involved in the whole value chain. We look at startups that deal with new business models based on shipping data, providing supply chain transparency.

Startup stages



Unfunded: A startup that has not received any money from investors.



Seed: At this stage, a startup receives its first 'official' investment. This investment is used to finance the initial activities that will help get it off the ground. At this stage, the startup is looking for a repeatable and scalable business model.



Series A: This stage is often marked by the first venture capital investment. To be able to receive this funding, a startup has to be able to show some traction. This could relate to its user base, revenue streams or other key indicators of its ability to move from an idea to a real business. However, it is still testing and experimenting with the actual business model.



Series B+: After a Series B investment, a startup moves from the development stage and demonstrating proof of traction to taking the business to the next level: growth. By now, the company is well-established, and once past Series C it is often successful. It looks for further investments to be able to expand into new markets or acquire other companies.



Exited: The most common exit strategies for a startup are being acquired, merging with another company, or filing for an IPO/ICO.

Performance management

Current trends from the global startup scene

Performance management is essentially about cost savings and de-risking vessel operations by introducing new technologies that facilitate and enable optimisation of vessel operations. Within performance management, we have looked at two types of startup:

- Startups that work within vessel performance management
- Startups that work within fuel and energy management

We have analysed 31 startups in this category. The majority of them, six out of ten, focus on vessel performance management. These startups typically offer system performance monitoring together with analytics and predictive maintenance. The aim is to collect and use all available data to facilitate the shift in maintenance from being preventive to being predictive. Predictive maintenance allows cost savings through increased longevity of equipment, increased uptime and higher utilisation of vessels. Companies

like [c3iot](#) predict equipment risk, failure likelihood, and required maintenance actions for their clients. Within fuel performance, startups such as [We4Sea](#) and [Eniram](#) offer vessel operators an opportunity to monitor and react to their fuel usage with a focus on reducing bunker costs and ship emissions.

TECHNOLOGY AND BUSINESS MODELS

Significant reductions in the prices of Internet of Things (IoT) sensors and advances within machine learning and artificial intelligence have allowed startups to enter this category. Sensors placed directly on the equipment

Startup spotlight - Nautilus Labs

Nautilus Labs is a machine learning-based analytics platform encompassing hardware and cloud-based solutions for the maritime shipping industry. The platform enables maritime vessel operators to collect data using auto-logger hardware and analyse on-ship data to optimise the performance of vessels.

Besides collecting data with its auto-logger hardware, Nautilus Labs also allow companies to unify and automate data from external datasets. By adding machine learning, the company aims to achieve predictive voyage and vessel optimisation.

Its solutions are cloud-based, which means that it allows distributed teams to collaborate around the key data and insights that matter to them. It claims to have already enabled a reduction in operational fuel waste of 3%.

USA | \$ 2M | 2016 | SEED



allow for assets to be continuously monitored during operation and enable collection of data that can be analysed in real time to anticipate equipment failure or fuel usage. This is the first step towards increasing the connectivity of vessels and extending the lifetimes of existing vessels. However, not all startups are focused on building IoT solutions. More than half of the startups we have identified primarily leverage collected data to create insights, without owning or creating IoT sensors themselves. These startups are based on software-as-a-service (SaaS) or platform-as-a-service (PaaS) business models and deliver their products in business intelligence suites. The rest focus on building IoT solutions in combination with data analysis solutions to unearth insights. Specifically, startups within fuel management mostly focus on building IoT solutions (70%), while the startups within predictive maintenance mainly work on leveraging existing infrastructure and data (68%).

TRACTION AND FUNDING TRENDS

In total, these 31 startups have received USD 360 million in funding, with the majority receiving their latest round of funding in 2018. The low freight markets and declining

economic lifetimes of existing vessels are increasing demand for cost-saving initiatives.

These types of initiative are at a more advanced stage in other industries, which may help speed up the startups' recent development. The majority of startups that have received funding are in an early phase, which means they have attracted seed and Series A funding. At the seed stage, startups have not yet attracted any interest from venture capital investors and are in a phase of

experimentation, trying to find the right value proposition and business model. By looking at startups that have moved on to raise Series A funding, we can try to understand which problem needs to be addressed and which products there is a need for in the market, as the presence of venture capital investors is an indicator of a recognised need/problem in the market.

Innovation within the field of performance management is still a relatively young,

Startups founded over time



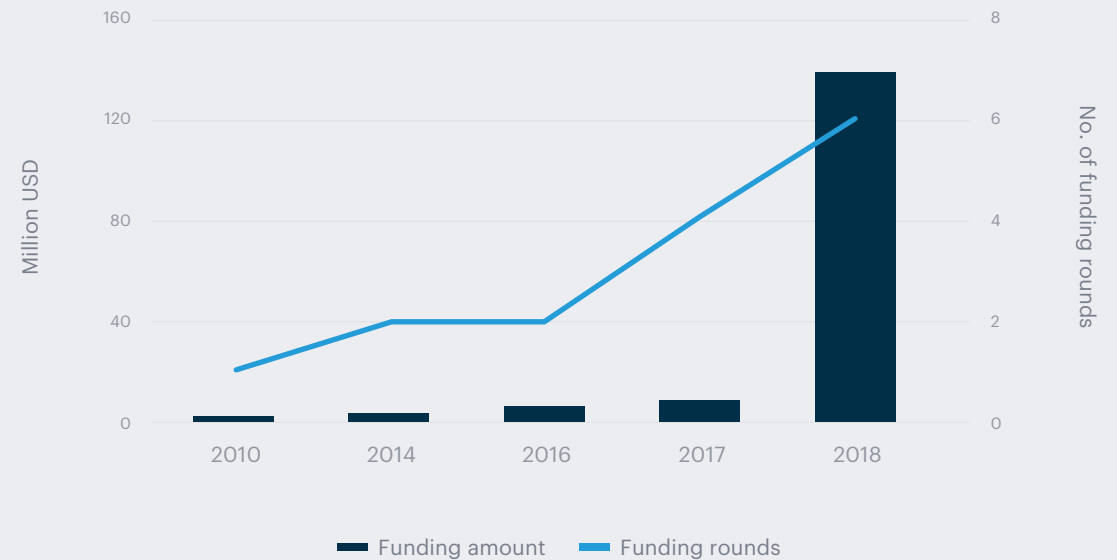
but evolving, market within the maritime sector. The movement from seed to Series A funding is evidence of early-stage growth for startups, and this category can be expected to develop further in tandem with more widespread technology adoption onboard vessels. Of the total funding allocated in this category, nearly 40% was distributed in 2018. We expect that more companies will begin to utilise these opportunities in the years to come.

LESSONS FROM OTHER INDUSTRIES

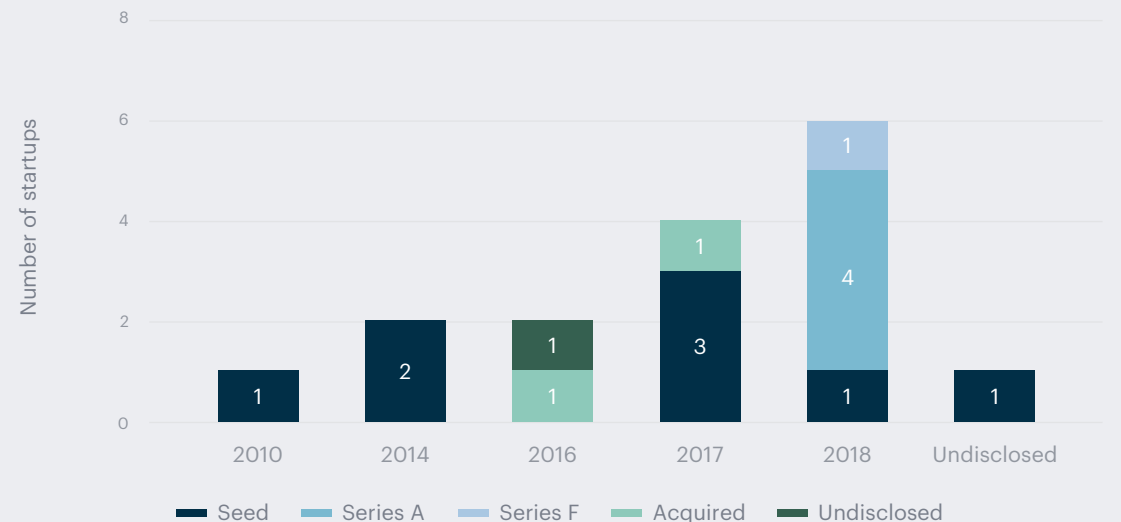
Other industries, such as manufacturing, have developed more mature performance management solutions. Looking at how startups have developed in other industries and which business models have proved successful, and why, can help us understand the road to success for maritime startups.

In manufacturing, we have identified more than 70 startups within performance management, many of which have progressed beyond Series A funding, indicating a more mature market with some players closer to identifying viable business models. Moreover, four of the five best-performing startups work

Latest funding amount and rounds



Funding stages over time



purely with analytics, without building IoT hardware, and operate across industries to offer more than one solution, such as digital twins, diagnosis as a service, or intelligent monitoring.

The maritime industry is lagging the manufacturing industry but shares characteristics in terms of hardware, operations and supply chain dependencies. Analysing how innovation has played out in manufacturing gives us an indication of where the maritime industry may be heading. The winning models in manufacturing have built cross-industry capabilities in data analysis and prediction and strong offerings in cybersecurity, whereas the maritime industry has only just embarked on this journey and the innovations it has achieved so far are very specific to predictive maintenance and data analysis. If the winning models in maritime end up being similar to those within manufacturing, traditional industry players and startups are looking at a reality where it will be those with cross-industry capabilities and a holistic approach to data analysis, applying technologies such as AI and big data analysis, that will succeed. This suggests that these kinds of solutions will be achieved through collaboration, rather than built individually by single players.



Startup spotlight - Arundo

With offices in Oslo, Houston and Silicon Valley, Arundo Analytics provides cloud-based software for the deployment and management of enterprise-scale industrial data science solutions. Arundo works with industrial and maritime companies to increase revenue, reduce costs and mitigate risks through machine learning and other analytical solutions that connect industrial data to advanced models and connect model insights to business decisions.

Its data can be applied in equipment condition and performance monitoring (CPM), to help predict failure before it happens and for marine asset management.

In 2016, Arundo graduated from Stanford University's StartX accelerator programme and subsequently received investment from the Stanford-StartX Fund.

USA | \$ 32.6M | 2015 | SERIES A

ARUNDO



Capacity optimisation

Current trends from the global startup scene

Capacity optimisation is about increasing the transparency of the global movement of goods with the aim of discovering and quantifying trading opportunities. This involves monitoring, tracking and measuring cargo volumes to reach a clearer understanding of global trading patterns, which in turn can enhance vessel deployment, repositioning and cargo routing. Ultimately, capacity optimisation should facilitate optimal matching of supply and demand.

Within capacity optimisation, we have looked at two types of startup:

- Startups working with data capture of vessel and cargo movements
- Startups working with data analytics of global cargo movements

We have identified 40 startups in this category, 65% of which work with data capture or tracing data of vessels and their cargoes. These startups provide data

that can enable centralised visibility into the movement of goods and the ability to locate and track goods. By analysing this data, companies can gauge traffic density or trends in specific geographical areas, and understand and predict the arrival and departure of specific cargoes or vessels.

[HawkEye360](#), for example, provides highly accurate maritime situational awareness data that can be utilised to elevate commercial planning and monitoring to the next level. This data can increase the efficiency of the cargo transfer, by improving the speed at which the global supply chain can be

Startup spotlight - Kayrros

Kayrros focuses on providing predictive analytics solutions to the energy sector, especially the oil and gas industry. The company combines machine learning, mathematics and quantitative finance with petroleum engineering to gain insights into the oil and gas industry.

The company integrates unstructured data such as satellite imagery, social news, GPS, traffic flows and requests for drilling permits with larger-scale financial and technical data. By combining and analysing this data, Kayrros is able to help clients predict crucial future physical movements of commodities.

Kayrros has received funding from Index Ventures, a venture capital firm that has also invested in Facebook, Slack, Dropbox, Deliveroo and more.

FRANCE | \$ 34.4M | 2016 | SERIES B



optimised. Moreover, analysing historical data on cargo positioning can help predict future movements and thus mitigate the risk of empty back-haul voyages. Startups such as [Transmetrics](#) are working with these types of challenge, aiming to predict cargo volumes in order to reduce empty capacity before it occurs.

TECHNOLOGY AND BUSINESS MODELS

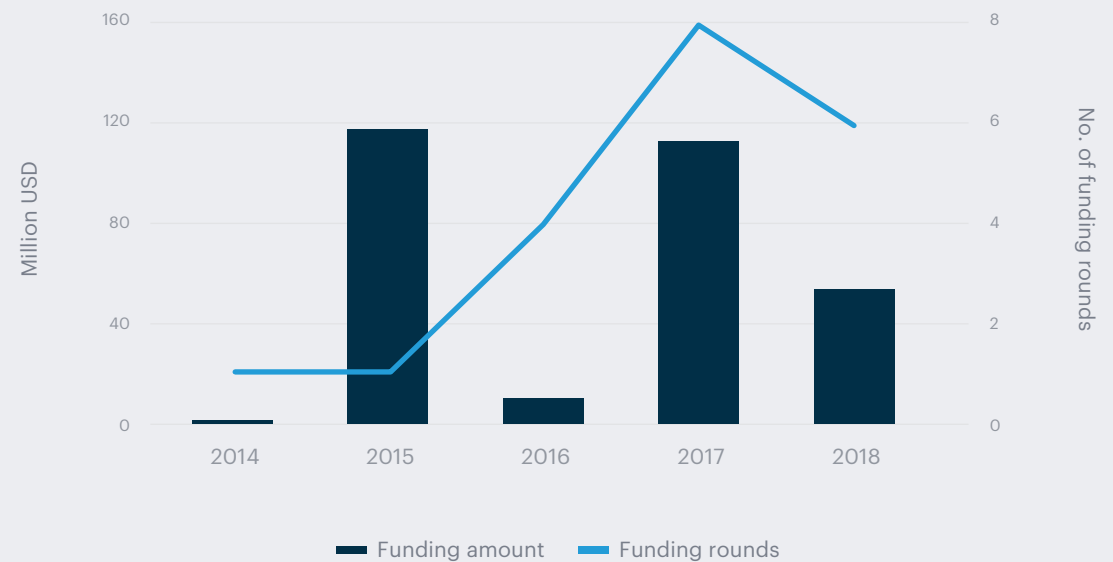
Looking at these startups gives us an idea of what data can do for the maritime industry and how it can be utilised. Most of the startups in this category provide services based on data gathered, and 45% of them use the data to provide different software-as-a-service or platform-as-a-service solutions.

Meanwhile, 30% of startups have built some type of IoT solution with the goal of tracking cargoes or assets. Container monitoring sensors have existed for a decade, but it is only in recent years that the cost of hardware and satellite tracking has come down to a commercially viable level. Startups like [Traxens](#) enable logistics companies to monitor and track real-time cargo locations using low-power wireless IoT sensors.

Startups founded over time



Latest funding amount and rounds



Most of the remaining startups focus on providing data-as-a-service. Some of these, for example, allow companies to access geospatial sensor datasets, such as real-time ocean, air or climate data.

TRACTION AND FUNDING TRENDS

In this category, startups have raised a total of USD 615 million. Those that have received the most funding are startups working with satellites and satellite imagery data. Funding peaked back in 2015, but the capital that year was placed in a single startup. This company entered the maritime space from another industry at a growth stage, which explains why it appears to be so far ahead of other startups in this field and why the amount of funding it attracted was so high. This is an interesting observation, as it shows that besides maritime-specific companies, we can expect startups from other industries to enter this space.

The majority of startups received their most recent funding in 2017, but a few have also received funding in 2018, indicating that many in this category are showing promising growth. Moreover, by the end of the year more investments might have been made.

This funding trend indicates that market acceptance of these startups and technology adoption in the industries to which they cater have increased over the last year. One in four startups in this category has succeeded in progressing from the seed stage to bringing venture capital investors onboard in Series A funding. These startups have a significant lead over others that will later try to capture this value pocket in the supply chain.

There are also startups that have moved past Series A to receive Series B and C funding. Most of the startups at these later stages

were founded between five and ten years ago, which confirms that building a company or developing a technology is complex and takes time. The group of startups in this category are more established and have progressed further than the rest, indicating that we could soon begin to see some of these take the lead in this market.

LESSONS FROM OTHER INDUSTRIES

Capacity optimisation in the maritime space

Startup spotlight - Descartes Labs

Descartes Labs is a deep learning satellite imagery company that was incubated at Los Alamos National Laboratory for seven years. Its products include features such as data pipeline (handling massive amounts of visual data from any sensors), image recognition (identifying important information buried in visual data) and pattern recognition.

Descartes Labs' platform can help organisations unlock the value of their own data in a variety of ways. Applications include monitoring of agricultural production, energy infrastructure, city growth, or environmental impact.

The company also builds custom solutions that deliver financial and operational advantages, such as structuring supply chain insights for global enterprises.

USA | \$ 38.3M | 2008 | SERIES B



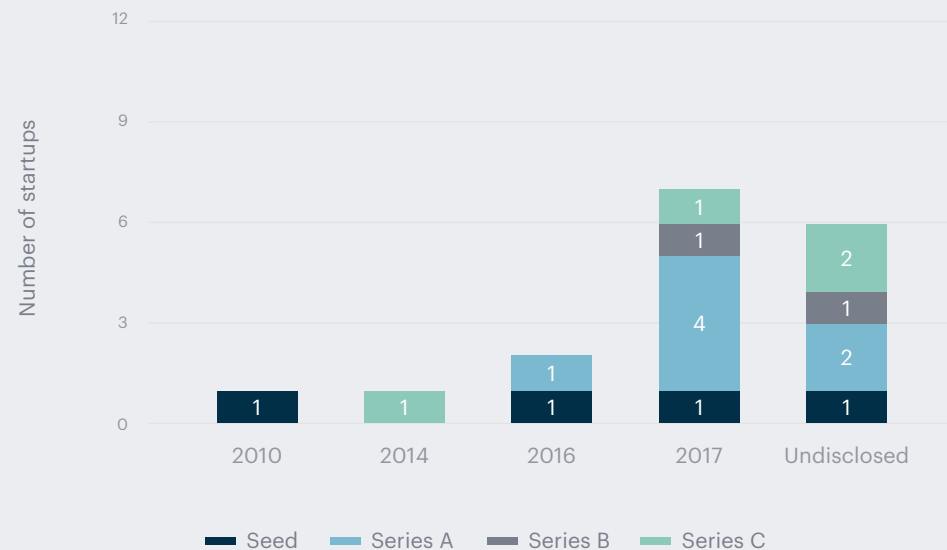
is mainly focusing on capturing data, and tracking cargo and vessels. Few appear capable of connecting the data to the broader supply chain yet. Looking outside the maritime industry, we see that the retail sector has made more progress in applying analytics to gain a trading advantage.

E-commerce retailers such as Amazon have a plethora of data about customers, their interests, preferences and past purchasing behaviour. These retailers have succeeded in turning advanced analytics of this data into predictions that have enabled them to meet customer demand better than traditional brick-and-mortar competitors. Their advanced data insights have also enabled them to offer same-day delivery in many geographical areas by making reasonably precise predictions about what goods to have in stock in certain areas and when they are in demand.

In the maritime industry, the few startups that have succeeded in connecting the data across the supply chain have mostly focused their efforts around energy markets, particularly oil and gas markets. In time, these companies can be expected to broaden their scope and move into other commodities, potentially impacting large parts of the shipping industry.



Funding stages over time





Value beyond the vessel

Current trends from the global startup scene

Value beyond the vessel is about identifying inefficiencies that can be eliminated throughout the customer journey from origin to destination. The aim is to unlock value by solving customers' pain points across the global supply chain. In the value beyond the vessel category, we have identified two types of startup:

- Startups that use shipping data to predict global trade movements
- Startups that bring freight forwarding online

Within this space, we have found and analysed 53 startups. About one-third of these generate insights by combining global trade data with multiple data sources from outside the industry. [Logindex](#), for example, has created predictive analytics solutions that seek to facilitate data-driven business and trading decisions in real time.

The remaining startups in this category offer digital services that enable the operations of

existing freight forwarders to be upgraded. This is one area where we are seeing existing players' businesses disrupted. There are three types of startup in this category. First, there are startups such as [ItsMyCargo](#), which

take freight forwarders online. Secondly, there are those such as [Flexport](#), which challenge analogue incumbents in the freight forwarding industry by being truly digital freight forwarders themselves. Finally,

Startup spotlight - Freightos

Freightos offers a software-as-a-service (SaaS) technology which allows logistics companies to manage contracts, and which automates and manages the quotation and sales process, both internally and from companies' own websites.

Freightos automates the quoting process for some of the world's largest freight companies, on all continents, and across air, ocean and ground, delivering the benefits of increased revenue and reduced costs. Freight vendors on the Freightos network can share rates and tariffs, allowing their sales people, agents and even customers to generate freight quotes from their internet browsers.

Freightos has recently raised Series C funding of USD 44.4 million and is now backed by multiple venture capital firms as well as General Electric's venture capital arm. Among others, it has received an investment from Aleph venture capital, which has also invested in WeWork, Windward and Lemonade.

USA | \$ 38.3M | 2008 | SERIES B



some startups have created marketplaces that connect shippers with cargo bookers, without the need for intermediaries.

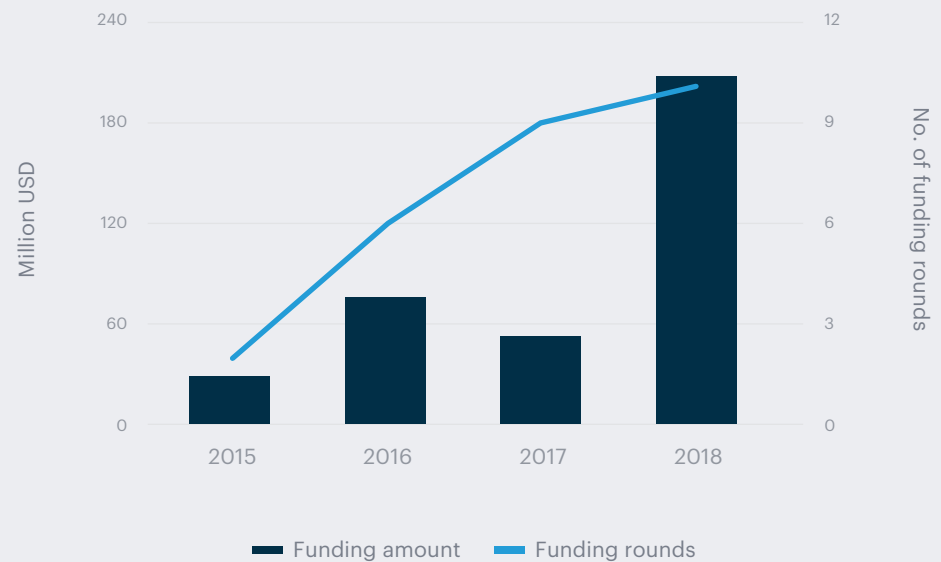
TECHNOLOGY AND BUSINESS MODELS

The use of algorithms and advances in machine learning and artificial intelligence increases efficiency, accuracy and transparency along the supply chain. What is interesting to see in this category is how startups are already coming up with new business models based on the data available. Startups that are engaged in predicting global trade movements are mainly focused on selling data-as-a-service. This means that they aggregate data and store large sets of data on the cloud, which is accessible to their customers. The remainder offer their clients a combination of software-as-a-service (SaaS) and platform-as-a-service (PaaS) or marketplaces. What their services have in common is that they increase transparency in an otherwise extremely opaque market. The SaaS or PaaS startups digitalise freight forwarding. Many of them have created platforms on which clients can get instant price quotes, and book and track their cargo, while others provide software

Startups founded over time



Latest funding amount and rounds



solutions to freight forwarders to optimise their processes.

The startups that provide marketplaces take different forms; some specialise in specific cargo types, serving small and medium-sized companies, or, for example, in connecting importers and exporters directly, while others offer a marketplace for all players involved in the supply chain.

TRACTION AND FUNDING TRENDS

The 53 startups in this category have raised the highest amount of funding, a total of USD 700 million. There has been a significant increase in funding received in 2018 compared to previous years.

Even though three startups dominate the funding raised, 2018 has also seen funding spread across the most startups. The three startups that have received the lion's share of funding appear to be significantly ahead of the rest, and their success serves to demonstrate the vast untapped potential from upgrading the surprisingly analogue business models in the freight forwarding industry. This has allowed a range of smaller startups to emerge and attract funding.

In terms of the various stages of funding, this is a differentiated group of startups with a few leading the race. Five startups in this category have raised Series B and Series C funding, indicating more mature businesses that enable them to work to scale and expand their products. A larger group of startups in this category are at the earlier seed stage, however, which implies that we can expect more funding rounds as they inch closer to finding scalable business models and improve their value propositions.

LESSONS FROM OTHER INDUSTRIES

When considering value beyond the vessel, we compare the startups targeting the maritime and logistics sector with those that have entered the travel industry. The travel industry was previously opaque and inefficient but has largely been transformed by startups and their digital business models. Today, the travel industry is leagues ahead of the maritime and logistics sector.

Startup spotlight - SpaceKnow

SpaceKnow is an AI-driven platform which provides analysis of the global economy by tracking global economic trends from space. Users can track and predict global economic trends, perform scalable and automated tracking, monitor assets and process insurance claims with minimal risk, track construction projects and properties, and monitor agricultural and environmental changes.

As an example, combining machine learning algorithms and computer vision techniques – and using commodity movement as one of the input factors – SpaceKnow is able to tell a country's economy trend.

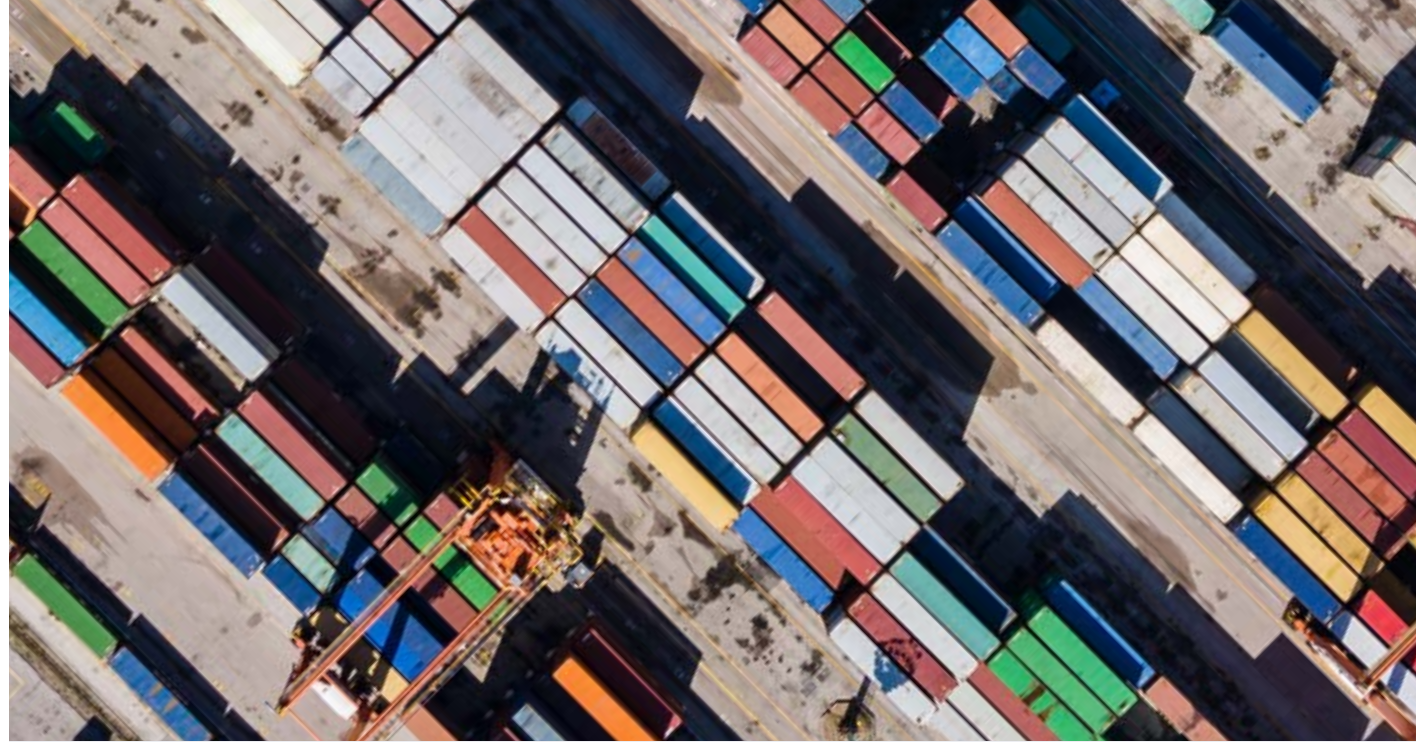
Using Google Cloud Platform, SpaceKnow is currently building a scalable and robust geospatial supercomputer.

USA | \$ 5.5M | 2013 | SERIES A

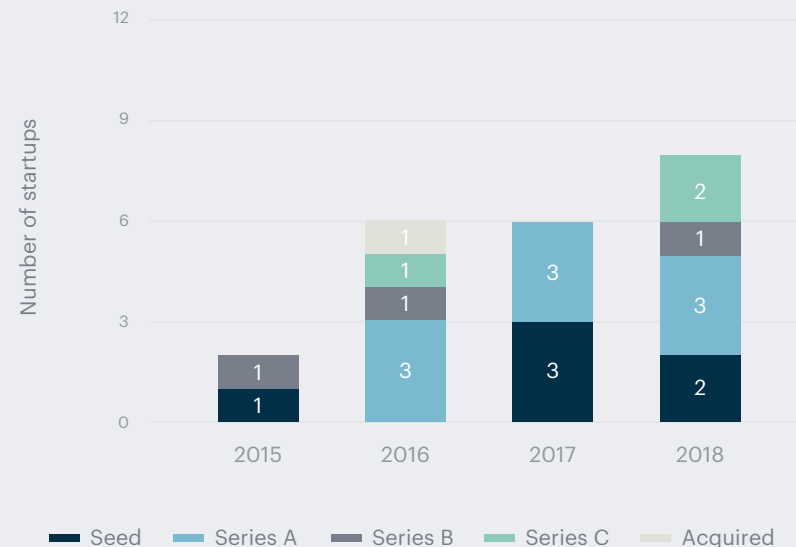
SPACE_KNOW

In the online travel industry, there are more than 80 companies that began as startups but are now regarded as megacompanies. Yet, just three players - Airbnb, Booking Holdings and Expedia - dominate the market. These three have captured large shares of the transaction value by introducing 'metasearch marketplaces' that offer pricing transparency.

Although the two industries are very different and cater to different types of customer, we see several similarities, even at this early stage. The startups that have attracted the most funding in the maritime industry are equivalent to the marketplaces in the travel industry - they focus on creating platforms where different stakeholders are able to interact, and they thus become the digital middlemen. In the maritime sector, this likewise introduces price transparency and facilitates easier booking of cargoes. Eventually, we could see some of these companies take larger shares of the transactional value in the maritime sector.



Funding stages over time





Reinventing the operating model

Current trends from the global startup scene

Reinventing the operating model for the shipping industry is about expanding the services provided to customers and eventually reaching a point where those services have become the core income generators. It is essentially about the end-customers and about linking the shipping industry more closely with the related value chains both on the cargo side and on the asset owning side. We have identified two main types of startup in this category:

- Startups working to provide supply chain transparency
- Startups that create new business models based on shipping data

We have looked at 36 startups in this category. As the broad definitions above indicate, the startups in this category are highly diverse. However, startups that work to provide transparency across the supply chain and those that track the condition of cargoes form the majority in this category. Most of the startups that aim to provide transparency

across the supply chain enable customers to identify and track products through the different stages. For example, [Blockverify](#) offers a solution to ensure authenticity of products, while [Modum](#) enables companies that ship high-value or sensitive cargo, e.g. pharmaceuticals, to monitor the condition of their cargo in real time. Other startups in

this category are based on sharing economy principles and include [Sokohali](#), which offers a delivery network that enables sellers and shippers to deliver goods constantly from any point of origin to any destination in the world by renting the facilities and services of other members on the network.

Startup spotlight - Tive

Tive has developed a connected tracker which can be used for tracking the location and condition of goods in transit. Its tracker uses GPS signals to track the location of cargo and communicates using the cellular network. The tracker is equipped with sensors that can monitor the vibration, shock, orientation and ambient environment (humidity and temperature) of the goods. The company has also developed a cloud-based platform that can be used for tracking shipments, creating alerts and planning shipments. Its solution developed can be integrated with third-party systems using an API.

Tive received 'Silver' in this year's IoT Innovator Awards in the category for Best IoT Service – Commercial and Industrial.

USA | \$ 4.9M | 2015 | SEED



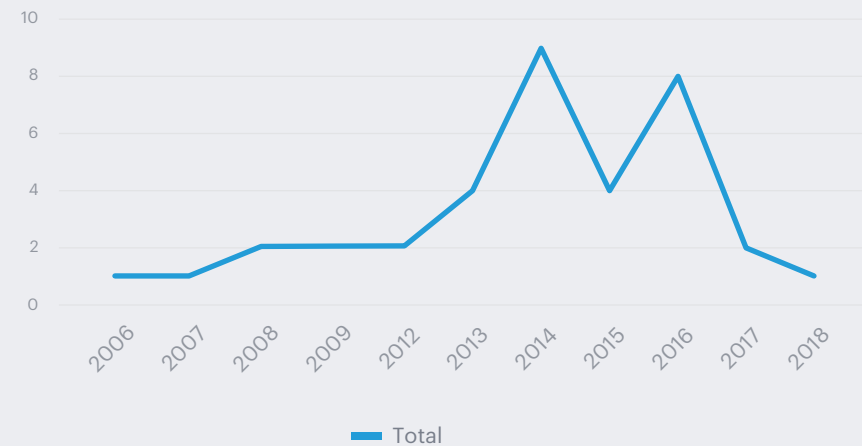
TECHNOLOGY AND BUSINESS MODELS

Blockchain technology and internet-of-things (IoT) devices have entered the realm of logistics, offering the opportunity to enhance traceability and transparency through data sharing. Blockchain technology deployed along the supply chain can help stakeholders record details about products, their origin and their journey. Significant reductions in the cost of IoT devices enable large-scale deployment on individual products or cargoes to allow real-time monitoring. About 40% of startups in this category offer hardware IoT devices coupled with digital, often cloud-based interfaces through which users can follow the data. Nearly all the remaining 60% in this category deliver blockchain-supported solutions in the form of SaaS or PaaS, which allow users to track the provenance of certain goods, exchange data, follow products' progress along the supply chain, and trace goods.

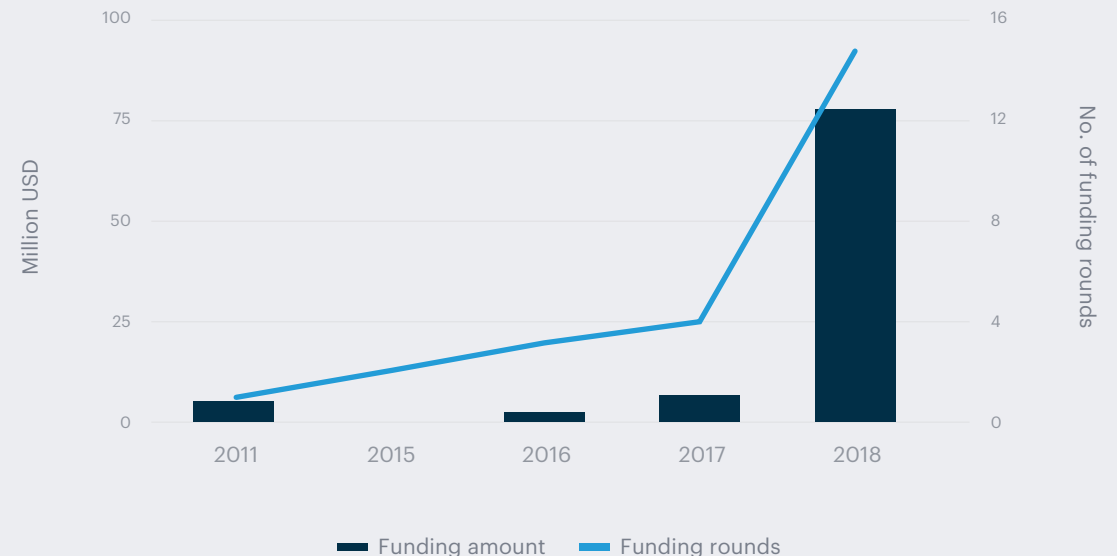
TRACTION AND FUNDING TRENDS

The startups in this category have received the smallest amount of funding, USD 290 million in total. However, similar to the

Startups founded over time



Latest funding amount and rounds



other three categories, 2018 marks the peak of funding for these startups. In previous years, only a few startups received funding, but 2018 has seen a dramatic increase with 13 different companies obtaining funding. Despite being behind in terms of funding, the companies in this category are also quite dynamic and we are seeing startups at many different stages of development. The majority are still at the seed stage, indicating that they are only just beginning to find new ways in which to create additional value for customers or develop products that can diversify revenues for corporates. A number of startups have managed to obtain Series A funding and a few have progressed beyond Series A, indicating that some are finding early success.

When we look at how the funding stages for these startups have developed over time, it is clear that 2018 has been a stellar year in terms of new activity and development. A number of new startups have entered the fray and received seed funding this year. This might be a sign that the market is becoming more accepting of outside solutions and could indicate potential for further development. In addition, we see that those startups that have moved beyond Series A funding have done so in 2018, which implies that some have been

successful in producing early growth and could pave the way for others to progress to later-stage funding; until this year, venture capital investors' interest in this category has been relatively subdued.

LESSONS FROM OTHER INDUSTRIES

If we look at any industry that has undergone significant change and reinvented itself, it is

clear that it is not just one startup that drives the change but rather a series of events, companies and technological developments. While we are confident of the potential of technologies such as AI, machine learning and blockchain, we are unable to single out one startup or business model as being the next big thing.

We have looked at startups that define entirely new markets or provide new

Startup spotlight - Slync

Slync provides AI-enabled software solutions for supply chain visibility and traceability. It offers a suite of blockchain-based supply chain applications, which are integrated onto a supply chain platform via APIs. The platform provides solutions to track and trace products across the entire supply chain, with features including intelligent workflow management, AI-enabled data-driven analytics and insights, blockchain-based verifiable transaction management, and more. The solutions can also be integrated with other third-party systems. Use cases include product traceability for manufacturers and suppliers/retailers, and multi-modal shipping and transportation management for the logistics industry.

At this year's Transparency Demo Day, an event at which startups showcase their tech-oriented products within transport, Slync was voted one of the 'Best in Show'.

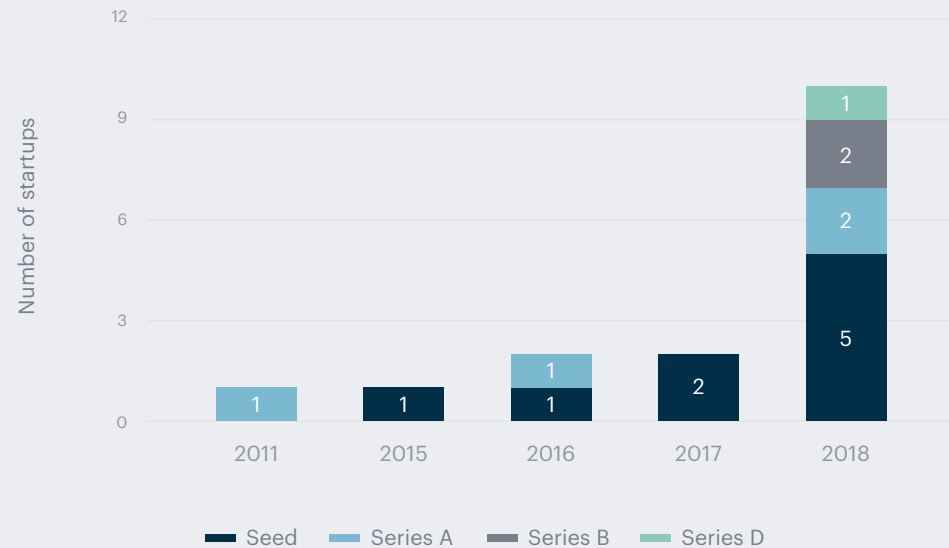
USA | \$ 1.7M | 2017 | SEED



services that could eventually develop into dominant revenue streams for incumbents in the maritime sector. While it is already apparent that some startups provide more value than others, it is hard to tell whether a new business model that will usurp the existing one has already been developed. However, working on additional building blocks from the other three categories can help us understand how and which startups are set to reinvent the current operating model in the shipping industry



Funding stages over time



Perspective and key takeaways

The shipping industry is undergoing a fundamental transformation as it moves from being volume-based to being value-based. This transformation is being driven by the introduction of new technologies that are allowing new business models to emerge. Looking at other industries that are further along in their digitalisation journey, we see that the data generated by shipping operations is an untapped resource that the industry needs to learn to harvest.

INNOVATION IN THE AGE OF OVERCAPACITY

The shipping industry is struggling with surplus capacity, which is putting it under extreme pressure to do more with less. This makes the case for new approaches to vessel operation that focus on improving performance management and capacity optimisation. But we are also seeing strong growth in new initiatives that are working to create value beyond the vessel by integrating operations across the supply chain. Reinventing the operating model is clearly

the biggest challenge, especially outside the current ecosystem. Some initiatives are being made, but most of these are relatively young and early in their expected lifecycles.

PROMISING SUCCESS STORIES

We are already seeing promising startups in many different areas of the supply chain, which demonstrates that the enormous potential is real, but it is still largely untapped.

Based on the 160 startups that we have analysed, funding activity has increased dramatically in 2018, with 68% of the capital that we have tracked having been raised this year.

Startups in this space are highly diverse, and range from those that have not raised any funding to those that have raised over USD 200 million or have been acquired. More than 40% of total funding raised has been Series C funding. Series C funding is generally provided to successful companies to enable them to scale up fast and broadly. Series C

funding raised in 2018 accounts for almost one-third of the total funding raised in our survey.

THIS IS NOT ONLY ABOUT THE VESSELS

Some startups set out in other industries but are now applying their capabilities to the maritime space, while others originate directly from the shipping industry.

Comparing the digitalisation journey of the shipping industry with that of other industries that have progressed further, we believe the shipping industry is close to an inflection point. It is likely that the shipping industry's adaptation to new technologies and new business models will intensify strongly within the next five years.

COLLABORATION ACROSS THE ECOSYSTEM

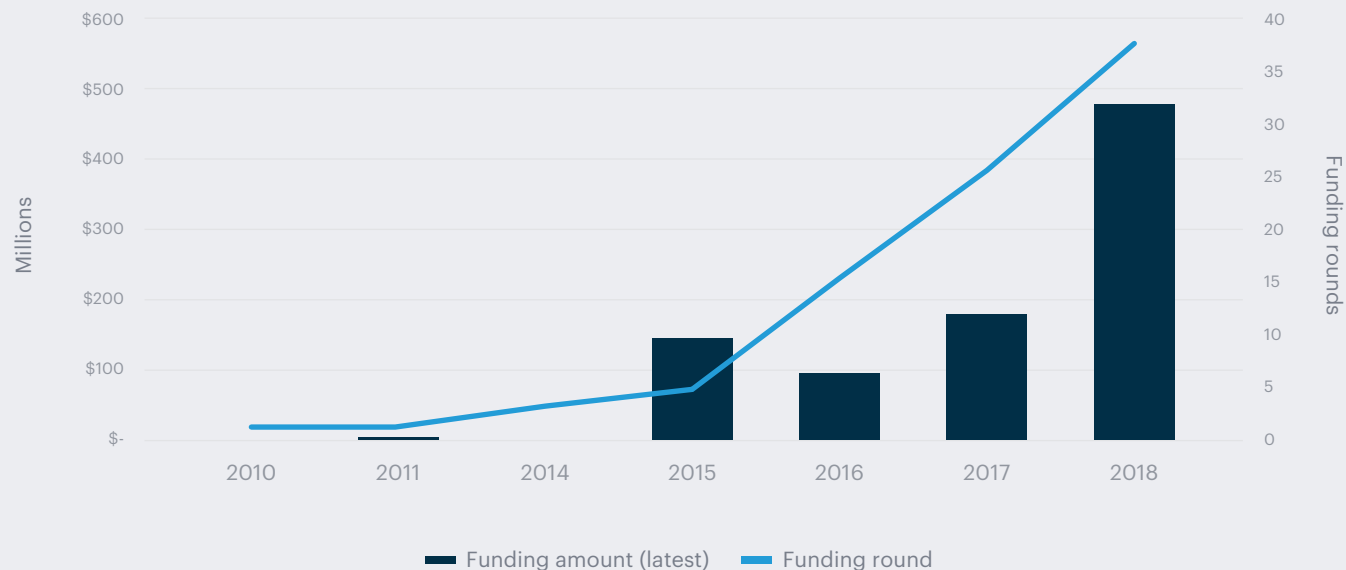
The shipping industry is a fragmented but interconnected part of the maritime ecosystem and the broader global supply chain. There are no large, dominant players across ship segments. Each player possesses unique knowledge, assets and data, but these only constitute individual pieces of the global supply chain. These challenges are not unique to the shipping industry; other

industries have faced similar problems. We have learned that if players collaborate across a diverse ecosystem, they can turn innovative ideas into validated prototypes enabling value to be unlocked from opportunities that emerge from the introduction of new technologies and new business models.

The majority of startups are enablers of growth rather than disrupters of traditional shipping players' existing business models. This means that the door to collaboration is open, which can benefit both corporations and startups.

Collaboration will allow corporations to enter new markets, and startups to develop and scale up their products – potentially a win-win situation for all parties. Still, it is important to keep in mind that there is no such thing as a silver bullet. Each opportunity is hard to identify and fully understand, and a blend of different capabilities will be required in order to succeed.

Funding amount and rounds of all 4 categories





CHANGING ROLE OF THE VESSEL

Industry transformation

The road to digital transformation

The transformation process

Our aim is to set out a roadmap for the shipping industry's transformation towards a digital future. When companies begin to acquire end-to-end visibility into the data exhaust from their operations, they can begin to experiment with new business models and more integrated customer experiences. In time, the data from their operations could prove at least as valuable as the transactions themselves. But we are not there yet. How will the short and medium term play out?

The low freight rate environment, which has persisted for large parts of the past decade, has spurred a consolidation process on the vessel-owning side. This trend seems to be continuing, and we are also beginning to see a clear trend towards increasing digital investments.

Shipowners who run integrated businesses, where both technical and commercial management of their fleets are handled internally, are most likely to invest in initiatives to upgrade both the cost and

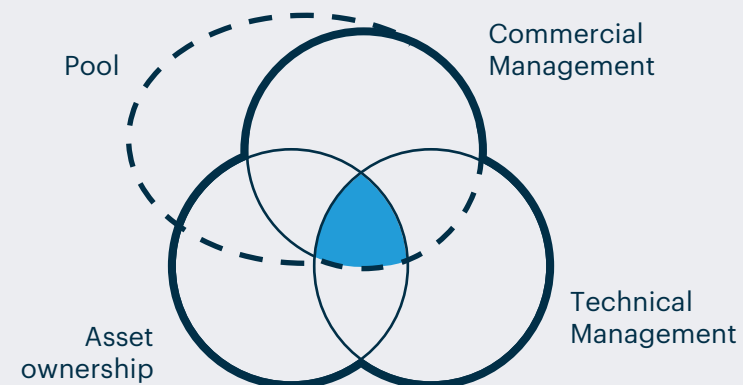
the revenue side of their operations. These investments could be made in sequence or in parallel, or perhaps by merging with others or simply acquiring candidates that have already mastered the requisite skills. But not all players are running operations that would offer more than operational scale in a consolidation.

The early stages of the digital transformation

will see a push towards cost leadership. This is about the introduction of remote predictive diagnostics and automated processes powered by big data analytics and artificial intelligence. These new tools will be used to enhance the performance management of the industry, drive down costs and increase the uptime of vessels.

Existing vessels will be given digital makeovers

A simplified business model



to enable significant improvements in their operational performance. The next generation of ships will be super-connected assets, with all systems monitored and integrated on unified platforms in real time. The next step, or a parallel step, is capacity optimisation, which will lead to trading leadership. By applying artificial intelligence to satellite, AIS and other geospatial data sources, algorithms will seek to discover and quantify trading opportunities, and to optimise vessel

deployment, cargo routing, repositioning and much more. These investments can be made by both shipowners and operators.

Asset owners that simply supply their fleets to the market on long-term contracts have little incentive to invest heavily in digital initiatives that upgrade the performance management of their vessels or optimise capacity.

Still, there is a clear limit to the potential for both cost and trading leadership, since the journey from port to port can only be

optimised up to a certain point. In time, mastering these disciplines will become merely a licence to operate rather than a competitive advantage. When that happens, we will need to turn our attention to what will characterise an excellent shipowner in the digital age.



Shipping in 2030 – a scenario

The next generation

The digital transformation of the shipping industry does not necessarily mean a sea change for every company in every part of the industry at the same time. Different business models will be affected in different ways, although all players in all ship segments are expected to be impacted by digitalisation at some point.

MIDDLE MAN AMONG MIDDLE MEN WILL DISAPPEAR

Shipowners that simply play the role of middle man among middle men may eventually disappear, since traditional shipowners and ecosystem players will not be competing on equal terms. Their revenue streams will be significantly different. Traditional shipowners trade cargo from port to port and earn freight rates (asset owners rent out ships). Ecosystem players may operate vessels, but they will view these as little more than the infrastructure enabling them to serve their customers throughout a journey that

includes seaborne transportation. Their primary income will not be freight rates, but income generated by the services they offer throughout the entire customer journey – from origin to destination. We acknowledge, though, that traditional shipowners may earn additional profit from a successful asset game.

DIGITALISATION WILL TRANSFORM ALL SHIP SEGMENTS

The more standardised cargo types (e.g. container, iron ore, coal, oil and LNG) are widely considered the most likely to be digitalised first. The more fragmented parts of the industry are then expected to be digitalised as the potential from trading platforms is revealed. In this scenario, the digitalisation process will be gradual, but even niche markets will eventually be impacted, since digital platforms will provide a benchmark for all cargo types even before most of the cargo is handled digitally.

TAKING A NEW APPROACH TO DIGITAL TRANSFORMATION

However, the focus in this scenario is on seaborne trade where cargo is transported from port to port. It fails to consider the journey from origin to destination, which crosses seemingly unrelated industries. The journey spans activities that take place before, during and after the cargo has been shipped, and can be long, stretching across multiple channels and touchpoints, and often lasting days, weeks or even months.

UNLOCKING VALUE BY REDUCING INEFFICIENCIES

The global economy is an interconnected ecosystem that drives global trade. Global trade is likewise an interconnected structure, but we tend to look at it in silos (i.e. Container, Dry Bulk, Crude Tanker, Offshore Supply Vessels, etc.). In a future where the global supply chain has been digitalised,

we need to identify and commercialise the value potential. Value can be unlocked by removing inefficiencies across the global supply chain by, for example, reducing the need for inventories, optimising local price campaigns or increasing the transparency of the availability of goods. But it may likewise be possible to create new streams of revenue by understanding how a change in manufacturing location impacts local demand for petrochemicals, energy, trucking and labour, not to mention how these changes impact the trading patterns of feedstocks. These causalities may not evolve in sequence, but it seems clear that there is a close relationship between them that can be identified and commercialised.

WINNER TAKES MOST

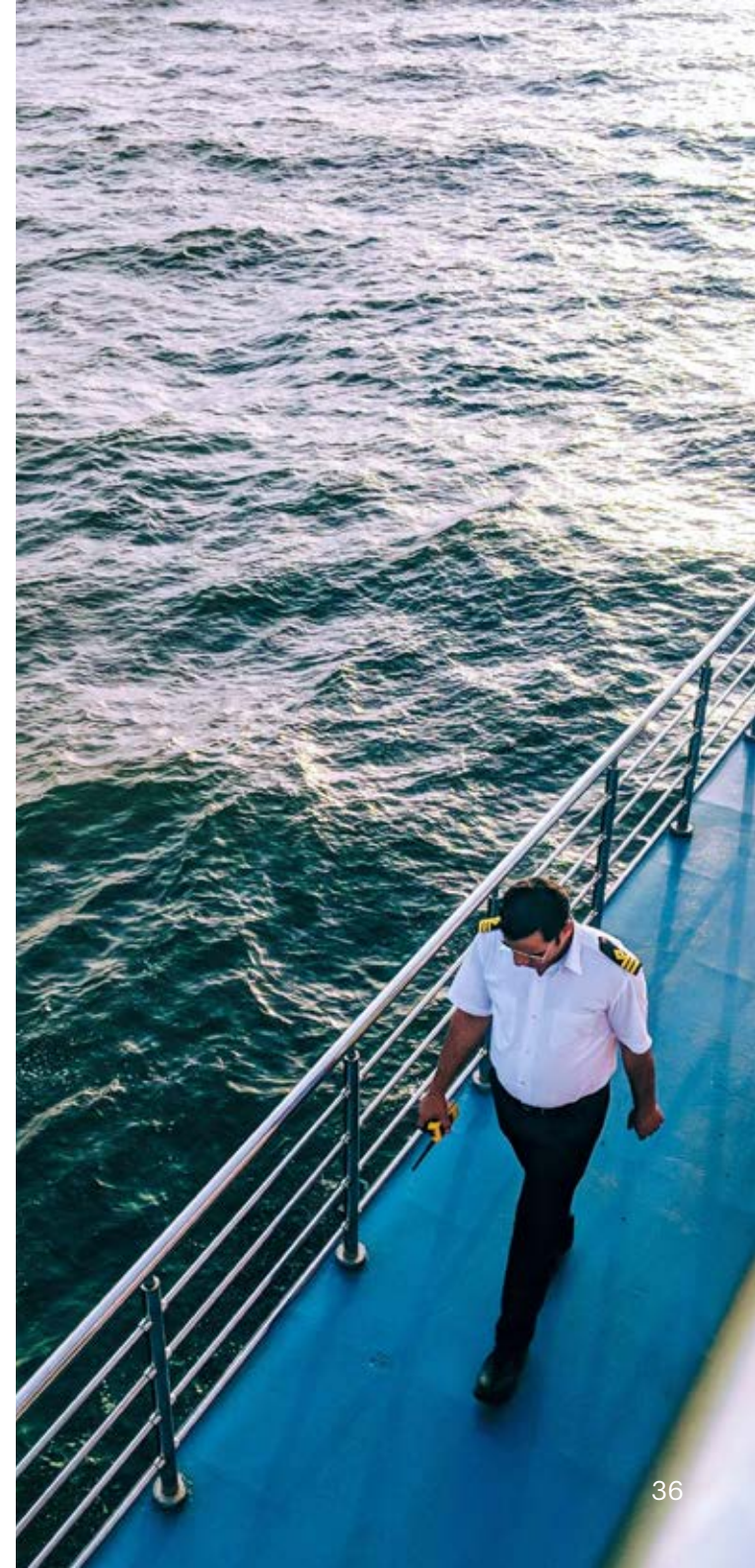
The most successful business models will remove costs from the system and simplify the industry. By pooling relevant content and creating 'one-click' solutions (e.g. trading platforms integrating the journey from origin to destination), the ecosystem players will begin to shape next-generation business models.



The sources of value creation in shipping will change

The digitalisation of the shipping industry is about to separate access to data from ownership of vessels. This may introduce a new type of competitor that works to upgrade specific parts of the supply chain. These ecosystem players are unlikely to own any vessels but may begin to change the borders of industries and the sources of value creation in shipping.

We do not know how the shipping industry will adapt to the emerging changes over the next decade. However, we have tried to combine elements in logical ways and then deduced the implications. Our hope is for this to be a useful thought exercise. We present two scenarios: 'value beyond the vessel' and 'reinventing the operating model'. These are certainly not the only ones that may transpire, but they illustrate some fundamental changes to the existing business landscape. The future may instead reveal a combination of these or surprise us with something entirely unexpected – or the status quo will prevail for longer.





POSSIBLE SCENARIOS FOR THE FUTURE

Industry redefined

Value beyond the vessel

The winners of tomorrow will create and lead an entire digital ecosystem

Digital destroys economic rent – creating more value for customers than for companies. It steepens the power curve by creating big winners and losers at the top and bottom, respectively. Digital rewards first movers and some superfast followers, but the top prizes are only available for the few. The behemoths of the future shipping industry (from 2030 onwards) are expected to share key characteristics; each will work to create and lead an entire digital ecosystem.

Digitalisation of supply chains has a more powerful impact on individual companies' performances than any other strategic challenge seen in recent decades. The reason is that a fully digital supply chain often involves the creation of new ecosystems, which leads to a fundamental reshuffle of how value is distributed among industry players. The traditional players' ability to sustain their revenue is under attack, and in time, their business models may be outright disrupted. To stay in operation, they will need to change their business models dramatically.

Digital attackers often combine digital supply chain play with platform-based business models. Companies like Tencent, Alibaba and Google are blurring traditional industry definitions by spanning product categories and customer segments. Owners of such hyperscale platforms enjoy massive operating leverage from process automation, algorithms and network effects created by the interactions of many users, customers and devices.

Vessels will continue to be vital for the global supply chain, but ecosystem players will monetise the data from operations rather than the cargo or the vessels themselves. Or maybe more precisely, some players will reinvent the business models of vessel ownership (e.g. vessel network subscriptions, also known as ship-as-a-service), while others will learn how they can monetise the broader customer journey from origin to destination (value beyond the vessel). These two business models, taking a variety of forms, are likely to shape large parts of the competitive landscape

towards 2030, but it is important to recognise that a third alternative may still emerge.

A group of traditional shipowners will continue to operate. Some will invest heavily to challenge the often asset-light ecosystem players, while others could transform into super-large entities that supply ships as network subscriptions to the ecosystem players. We expect only a small group of traditional players to renew their fleets after 2030, as we believe that new and potentially more attractive business model alternatives will be introduced (see example on the next page).

Reinventing the operating model

The next generation of vessel ownership

For all the fundamental change that digital reinvention demands, it is worth emphasising that it does not call for throwing the baby out with the bath water. For example, John Deere created a whole series of online services for farmers even as it continued to sell tractors and farm equipment.

The digital transformation of the shipping industry requires reinvention of the business models for vessel ownership. It makes little sense to speculate in assets that do not generate much direct income, offer few opportunities for differentiation and remain empty for prolonged periods. Vessel ownership needs to be transformed into a utility – a stable, low-risk business that harnesses all the benefits of standardisation, digitalisation and scale. We may see the introduction of a new type of ownership that supplements traditional types of vessel ownership and leasing structure.

We envisage the introduction of a vessel network subscription (ship-as-a-service).

This will be a new ecosystem play that could fundamentally change how value is distributed among all parties that contribute to the design of a vessel, its construction and equipment, its operation and maintenance, and eventually also its demolition. It can be a new product offered by a few super-large owners. The fleets of new digital vessels will be standardised to the highest levels of excellence possible to supercharge network effects and economics of scales. The vessels will be designed, built, maintained and recycled (i.e. cradle to cradle) by the same owner but could trade for ecosystem players (value beyond the vessel) who create value across the entire supply chain.

A network subscription will have a simplified payment structure and a guaranteed performance, plus benefits such as vessel swapping, peer-to-peer loans and insurance products embedded. The owner of the network subscription will be able to unleash significant cost-of-ownership tailwind throughout the lifetime of the vessel. The

owner of the vessel will presumably be an investment-grade entity that will accept a low but stable return on equity.

The introduction of vessel network subscriptions will not revolutionise the shipping industry initially. In the early stages, owners offering vessels to the market through network subscriptions will simply be viewed as a new type of tonnage provider supplying vessel capacity at a low fixed cost and with a guaranteed vessel performance. To a certain extent, a vessel network subscription can be viewed as a new product available for traditional owners working to further optimise their capital structures.

The role of the traditional shipowners will change, since their margins will come under attack from the ecosystem players that generates most of their revenue outside the freight market. The market share of the traditional players will diminish over time, since they will become less able to yield a return on invested capital if they do not innovate their business models.

The pace of change

Lessons from other industries

We have discussed the emerging digital transformation in the shipping industry and highlighted that shipowners may gain a short-term advantage if they achieve both cost leadership and trading leadership. These capabilities are the prerequisites for serving a truly digital global supply chain, but at some point in time they may prove to be little more than a licence to operate. We argue that additional business model innovation will be necessary for new streams of revenue to be unlocked.

How quickly and on what scale is the digital transformation likely to occur? We do not know. But it seems fair to assume that the potential consolidation of access to customers could happen relatively soon. Take the Chinese mobile payment market as an example. WeChat Pay was launched in 2013, while AliPay was launched back in 2009. These two services have reached dominant positions (a combined market share of more than 90%) in a major market in less than

a decade. The same could happen in the shipping industry.

It remains to be seen whether the digital transformation will dominate certain ship segments (e.g. Container ships) before others, but if the industry prepares itself for full-scale penetration, it may only end up with a competitive advantage if some niche markets continue to operate in the shadows for a little longer.

We find it unlikely that regulators would allow any platform to reach a market share close to what has been seen in China. But that does not change our key conclusion that the digital transformation will impact how the industry does business, who gains access to customers and how the industry makes money.

The future ecosystem players may view the trade transaction as a low-level entry point through which services can be added and

data on transactions and trade flow can be extracted. Today, both Alipay and WeChat Pay have myriad online services embedded in their solutions to increase their sources of revenue from their large customer bases, and also to help ensure that they retain — and expand — these huge customer bases by growing their portfolios of products. A similar situation could develop in the shipping industry.

Authors of this report

This report has been produced by Danish Ship Finance and Rainmaking Innovation. We share an interest in the future of the maritime industry and what new technologies and business innovations will bring.

RAINMAKING

Rainmaking is a corporate innovation and incubation firm. We design and execute innovation programs with industry corporations, and build and invest in tech startups. We have founded 30+ companies based on our own ideas and have invested in 680 startups. One of our key verticals is in maritime, logistics and transport and we continuously work with leading corporates and talented startups in these industries.



Danish Ship Finance is a specialised ship finance institution. Our only product is ship mortgage loans, and it is our aim to be the most recognised and stable provider of ship finance to reputable shipowners. We are based in the heart of Copenhagen where our experienced team of professionals work with customers around the world.

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Glossary

Asset owner - owns the vessel but supply it to the market through long-term contracts

Ship owner - owns and operate the vessel

Operators - combines vessel with cargos and are therefore exposed to the short-term movements in the cargo market

BI - business intelligence

IoT - Internet of things

IIoT - Industrial internet of things

SaaS - Software as a service

PaaS - Platform as a service

IPO - Initial public offering

ICO - Initial coin offering



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