Since the creation of the first maritime container port in 1956, the container shipping industry has primarily grown through scaling operations in which we’ve transported more than we did in the past at a faster rate. The industry is seen as slow to embrace new technologies, but could now be on the precipice of some big advancements.

We appear to be ready to implement digital technologies and tools to support the aggressive business plans that terminal operators are planning. The need to increase efficiencies, reduce costs and drive revenue throughout the entire ecosystem is driving the adoption of these new tools and technologies - all of which involve the data that resides inside this vast ecosystem.

Data and information circulating around these terminals can be categorized into 4 distinct segments. Each of these segments represents a step along the path to achieving sustainable growth and efficiencies across your terminal(s). These segments are:

1. Manual Input of Data
   Manual input of data simply means that the data and information being circulated within your terminal is being collected and analyzed manually. There is a significant amount of paper involved, and your staff is constantly updating and moving this paper to ensure your operations run smoothly. These terminals also tend to have complex processes in place which require training and mastering to ensure smooth operation of the terminal. Overheads of this kind can become expensive to maintain and retain.

2. Semi-Automated Input of Data
   Semi-automated input of data means your terminal has made some effort to start migrating some of the paper they use on a day-to-day basis over to using computers to input and share data. The staff you have on hand is leveraging information technology to enter the data and share it across the terminal electronically with the appropriate folks to analyze and make decisions. This is an inflection point for your terminal because you now have the ability to reliably store, process and reference the data you have collected and circulated to your benefit.

3. Automated Input of Data
   The third segment is the “automated input of data” where all of your terminal operations are performed electronically with the help of technology such as IOT and other mechanisms that capture and store data on their own. There is absolutely no paper involved and far
more data is being collected, processed and stored than ever before, giving rise to the adoption of digital infrastructure that we all refer to today as the cloud. The cloud enables one to seamlessly scale the infrastructure with the demand without having to worry about the costs associated with maintaining an on-premise infrastructure.

4. Automated Insights from Data
The fourth segment is “autonomous insights from data”. Now that data is being collected and processed automatically it’s important to start structuring and prepping the data to train a machine learning model. The more you train this model the better it gets at not only providing foresight beyond the terminal but also enabling autonomous decision making to take place within the terminal.

SUSTAINABLE GROWTH
Figure 1 depicts how better foresight can be achieved as terminals move from one segment to another, getting better at capturing data and leveraging technology to process that data. Eventually getting to a point where autonomous insights help bring the most foresight setting terminals up to scale and be productive well into the future. Though there are many examples that illustrate how sustainable growth and increasing efficiencies can be achieved, we will begin by exploring the ones listed below. These touch key aspects of the current maritime ecosystem and can bring significant foresight to the industry leading to sustainable growth:

1. Container Predictability
2. Predictive Maintenance
3. Vessel Path Prediction

CONTAINER PREDICTABILITY
The only way to track them is to physically read the identifier text on their door. OCR scanners have been utilized to do this a bit more efficiently, but still lack full visibility since the location is only known once it’s been registered by this scanner. This puts an unnecessary constraint when it comes to optimizing the container path, for example. Not being able to know the exact location of the container at all times, or what terminals it is near, eliminates the potential to fully optimize its route on its way to its final destination.

Another aspect of container predictability is when the container will be available to use. Correlating this with where the container currently is and what type of merchandise needs to be transported inside that container brings a sense of foresight that allows terminals to be far more productive than before. Once this data starts to flow and is captured in a consistent manner, machine learning can be applied to make decisions using container predictability more autonomous.

PREDICTIVE MAINTENANCE
Maintenance is another crucial aspect of terminal and vessel operations. Without adequate maintenance things begin to deteriorate, impacting terminal operations, productivity and revenue. There are many processes and procedures in place at terminals to ensure adequate maintenance takes place the required times, but this heavily relies on a schedule as opposed to insights related to the operation of the equipment that is actually being maintained. Collecting data on terminal and vessel equipment usage allows us to determine what equipment is best for the operation required.

For example, it may be slightly inefficient to utilize smaller equipment for a particular job, but it makes more sense if the larger equipment has not been adequately maintained. This foresight could save a tremendous amount of downtime and prevent productivity loss. Capturing data around maintenance and correlating it directly with the usage of the equipment in real-time allows the foresight to make the best decisions for your terminal operations. Machine learning can be applied once this type of data is being collected on a consistent basis to help make autonomous decisions on maintenance related actives both within the terminal as well as the vessel.

VESSEL PATH PREDICTION
Vessel path prediction is another aspect of the ocean supply chain that allows for a significant amount of efficiency to be built in. Today, the path a vessel takes is determined
beforehand and does not usually change along the way. This means that if there are obstacles ahead and the communication to the vessel is not advanced enough, the vessel will not have enough time to react leading to inefficiencies down the entire supply chain.

Fuel optimization is another aspect of vessel path prediction that is critical. The ability to tweak the path based on near real-time data can create a significant number of micro optimizations which lead to cost savings and productivity gains. There are many solutions within the industry that optimize vessel paths and are just starting to embark on the potential at hand. Capturing data that could potentially impact the vessel path and making it available near real time opens the door to optimizations that were not possible before.

There are around 53,000 vessels in circulation today.\(^1\) The amount of data generated if captured accurately will be sufficient to train machine learning models for power plants, ships, offshore rigs, connectivity and cybersecurity.

**CONCLUSION**

The opportunities for container terminals to increase efficiencies, reduce costs and grow revenue in a sustainable manner are now a reality – regardless of where each terminal is on its automation journey. Utilizing the vast amounts of data available, along with new machine learning technologies and tools is the key to achieving these promised advancements. Everything starts and ends with accurate and actionable data. The machine learning examples described above are just a few of the real world opportunities soon to be available to interconnected terminal operators today. Each segment of the connected ecosystem provides compounding benefits for all involved. Terminal operators that are realizing the promise of automation as well as other tools like machine learning applications will be well equipped to handle the projected demand of the future – in a more profitable and sustainable way.

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1 – [https://www.billiebox.co.uk/facts-about-shipping-containers/](https://www.billiebox.co.uk/facts-about-shipping-containers/)