

SMART CONTAINERS AND IoT TECHNOLOGIES

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Abstract. *The surge in online shopping has resulted in a higher volume of shipping containers in transit, leading to delays in ports and a worrisome increase in container losses. To address these issues, smart containers are emerging as a viable solution. Smart containers are equipped with Internet of Things (IoT) technologies, such as sensors and GPS tracking, which provide real-time data on cargo status and ensure the safe transportation of goods. As businesses strive to implement more effective strategies for production and error prevention, smart containers offer the opportunity for organized information flow and methodical supply chain logistics.*

Every day, thousands of containers arrive at seaports from countries all around the world. They are carried aboard liner ships, which offer regularly scheduled service on fixed routes, much like bus or train service does. Each shipment represents a specific supply chain, whether it is patio furniture from Thailand bound for a Milan retailer, avocados from Chile destined for a supermarket in Berlin, or shoes shipped from China to an athletic supply store in Europe or North America.

The transportation of cargo around the world is routine business for the shipping industry, but delivering about 11 billion tons of goods a year is a process that is fraught with risk. In November 2020, the ONE Apus container ship travelling from southern China to the U.S. lost more than 1,800 containers due to severe weather in what is thought to be the second-largest loss of cargo in history. And in January 2021, shipping giant Maersk lost 750 containers while on a similar course and then lost a further 260 containers a month later. Lost containers are not the only challenge of cargo transportation. Often, goods arrive damaged or spoiled at their destination because of poor conditions – unpredictable weather can be disastrous for food transit, for instance. It can lead to millions of dollars in losses but also raises questions about the sustainability of the way goods are shipped.

Smart containers are one way to create a more efficient, safe, and sustainable shipping supply chain. These are much like regular containers, but are pre-installed with sensors. “A smart container is just a regular container, but you put a little chip in it that has a connection with a network,” explains Jules Kollmann, managing director, Containers and Logistics, ING.

Smart containers are an exciting development in the world of logistics and supply chain management. These containers are equipped with various sensors and communication technologies that enable them to collect and transmit data about their contents and environmental conditions. Integrating smart containers with the Internet of Things (IoT) can significantly enhance their capabilities and provide real-time insights into the movement and status of goods in transit. Smart containers use a variety of Internet of Things sensors and devices to provide real-time tracking and monitoring of a variety of variables. These can include location tracking, temperature and humidity monitoring, shock and vibration monitoring, and more. By providing this level of detailed monitoring, smart containers are able to help shipping and logistics companies to better manage.



This technology can be combined with other innovations, such as blockchain, big data, or data pipelines, to provide even more facilitation to the trading community. In all of these cases, though, we see that creating clear, unambiguous message exchange standards will allow to capitalize on the full potential of the enhanced data.

The electronic devices incrementally installed on container fleets empower traditional containers to become smarter. Container monitoring devices and sensors encompass three general components that are increasingly combined to enable advanced monitoring:

- Identification;
- Location;
- Physical parameter monitoring such as temperature, humidity, vibration, etc.

Location-aware technologies, real-time reporting, handling and tampering control, environmental condition monitoring, hacking attempt recording, and related alarms and quality management functions are widely available. Such devices collect and monitor a variety of physical parameters and store and/or transmit related data safely. These connected devices are used to monitor service and equipment performance, and to remotely diagnose problems related to both the container itself and its contents. The Smart Container data may also include the following more detailed data elements:

- ETA Update;
- Actual Executed Transit Time;
- Empty at Gate-In at Depot;

- Depot Reconciliation;
- Trip Tracking;
- Haulage Container Time and all routing points passed; and
- Exception Alerts such as Schedule Deviation Alert, Unexpected Door Opening, Unexpected Temperature or Humidity Change, and Overlanded Container.

Table 1 - Smart Container Market record scope

Report Metric	Detail
Market Size Value in 2022	USD 3.9 Billion
Revenue Forecast in 2027	USD 9.7 Billion
Growth rate	19.6%
Market Size Available for Years	2018-2027
Base Year	2021
Forecast Period	2022-2027
Units	Value (USD Million/USD Billion)
Segments Covered	Offering Technology Vertical, and Region
Geographic regions Covered	North America Europe Asia Pacific, and RoW
Companies Covered	ORBCOMM Inc (US) SkyCell AG (Switzerland) Traxens (France), Phillips connect (US), Globe Tracker (Denmark), MSC (Switzerland), Ambrosus AG (Switzerland), Berlinger & Co. AG (Switzerland), and Shenzhen CIMC Technology Co., Ltd. (China).

Advances in IoT technology, such as the development of more advanced sensors and other devices, are also driving the increased adoption of smart containers. Smart containers are likely to become more popular in the coming years as these technologies continue to evolve and improve. This has the potential to have a significant impact on the shipping and logistics

industry, assisting in driving greater efficiency, reducing waste and spoilage, and improving overall customer satisfaction.

Conclusion

In the shipping industry, the challenge of transporting 11 billion tons of goods annually is underscored by container losses and damaged cargo due to unpredictable weather. Smart containers, equipped with sensors and IoT technology, provide a solution for efficient, secure, and sustainable supply chains. These containers offer real-time insights into cargo conditions, including location tracking and monitoring of variables like temperature and humidity. Integrated with innovations like blockchain and big data, these devices enhance trade facilitation, but clear message exchange standards are crucial. These advancements transform the industry, making it more efficient and resilient.

References

1. *UNECE UN/CEFACT. White Paper. Smart Containers, Real-time Smart Container Data for supply chain excellence*
2. <https://www.globalpsa.com/a-revival-in-smart-containers/>
3. <https://fastcompany.com/90690277/sensor-ships-why-smart-containers-are-the-future-of-shipping>
4. <https://www.globenewswire.com/en/news-release/2023/02/21/2611756/0/en/The-Rise-of-Smart-Containers-and-IoT-Devices.html>
5. <https://www.thecooperativelogisticsnetwork.com/blog/2021/11/19/how-the-advent-of-smart-containers-is-transforming-the-container-shipping-industry/>