

# Standards-based Smart Container Solution is key for supply chain shared visibility

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- Smart Container facilitates seamless transport and improves collaboration among stakeholders.
- Smart Container is using IoT as key technology to offer total door-to-door supply chain visibility and identify bottlenecks.
- Smart Container is a common base to link all stakeholders allowing for the delineation of their responsibilities.
- Smart Container leads to better resource usage, facilitating the shift to cleaner modes of transportation making the supply chain more resilient and sustainable.
- Smart containers contribute significantly to various United Nations Sustainable Developments Goals (UN SDG).<sup>1</sup>

## Data for services that matters

Smart containers hold promise for revolutionizing supply chains. However, generating and collecting smart container data is not enough to make supply chains "smart." Stakeholders already manage huge amounts of data and struggle with multiple technologies that take time away from their core businesses. A smart container solution must deliver data that matters, in a standard format for easy integration into different systems. It must enable unambiguous data interpretation and empower involved stakeholders with actionable information. When trip plans, cargo information, and other information is shared with service providers, smart containers may be configured to differentiate "business-as-usual" events and exceptions and create alerts when certain measures exceed the configured thresholds, allowing stakeholders to be informed to take action<sup>2</sup>. For example, if a container is sealed prior to shipping, the smart container solution can notify the appropriate stakeholder of the place and time of an unauthorized door opening.

Moreover, smart container data enables the creation of innovative value-added services such as Estimated Time of Arrival (ETA) calculation, optimization of container flow and fleet management, CO<sub>2</sub> emission calculations for the journey, as well as predictive maintenance.

## What is a smart container?

Smart containers are traditional marine containers – reefers, dry or tank containers – with added electronics enabling them to sense, interact, and communicate.

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<sup>1</sup> <https://sustainabledevelopment.un.org/?menu=1300>

<sup>2</sup> Becha H. (2020) The Power of Parameters in Smart Container Solutions: Delivering data that matters, from periodic events to context-based alerts: <https://maritime-executive.com/blog/the-power-of-parameters-in-smart-container-solutions>

Other modes of transport may use different kinds of containers -e.g. air transport uses Unit Load Devices (ULD), which may be fitted with a monitoring device to convert them into smart containers.

The added electronics enable tracking and monitoring of a container trip and the conditions under which the cargo has been transported. The smart container solution can be designed to share near real-time physical data regarding location, door opening and closing events, shocks and vibrations, temperature, and any other relevant physical parameters. Smart container data providing near real-time door-to-door trip visibility is one of the foundations for end-to-end supply chain visibility and excellence.

The smart container solution is based on various technical pillars:

- An active smart device (able to send data using its own power) affixed to the container; a self-powered device capable of collecting sensor readings and communicating these onwards.
- A cloud-based platform collecting the data, processing it and sharing with the different stakeholders.
- A catalogue of APIs for easy integration of the physical data into different other platforms; and
- Various communication protocols.

### **What are the benefits of smart containers?**

Smart containers are progressing the digital age of shipping one step further beyond paperless processes by embracing the Internet of Things (IoT) to support enhanced decision-making by the various stakeholders. They are an essential building block to complete the missing link to fully digitalize the supply chain. Smart container is a common base to achieve near real-time shared visibility between various stakeholders across the entire door-to-door trip execution. Shared visibility is key to enhance the stakeholders' collaboration and coordination as well as to delineate the responsibilities of each actor of the supply chain. Analyzing enhanced visibility aggregated over time enables actors to improve their processes, resulting in the reduction of transport lead time and costs. Smart containers may be combined with other innovations such as blockchain, big data or data pipelines to provide even more facilitation to the trading community.

The use of Standards-based Smart Container solutions guarantees the transparency of operational movements and events within the supply chain and provides benefits in many ways to the varied stakeholders, such as:

- Transport Operators (with container fleets) – facilitate efficient container fleet management and enable operators to offer a value-added service while ensuring better service quality. Having reliable information to act on and enhance processes mitigates risks and results in mastering operational costs.
- Container owners - improve fleet management efficiency by remotely accessing their container inventory as well as generating periodic (e.g. monthly) or on-demand reviews to reconcile container inventory with depot operators.
- Logistics Service Providers (e.g. handling operators, international freight forwarders, brokers) – obtain timelier and more accurate information on the status of the consignments as well as

faster knowledge of hazards or unanticipated events allowing better risk mitigation to ensure the consignments are secure and in safe condition.

- Consignors and Consignees – allow to take an active role in mitigating negative circumstances in a timely manner while enroute and to optimize their supply chain and monitor the quality of the products, enabling better inventory management. Smart Container data may decrease cargo loss, packaging costs, non-quality costs, the levy of fines, legal costs, insurance fees and investigation processes, damage to goods, the number of back orders, cancelled orders and the number of defective products delivered. Reliable smart container based ETA help to plan the work related to handling the container (stuffing / destuffing) much better and thus significantly decrease operational costs.
- Vessel crew - enhance operations on board vessels by enabling the crew to remotely monitor the count of full and empty containers, determine temperature of the reefers and to ensure that the engines of the reefers are running correctly, thus saving cargo that otherwise would be discovered when delivered as damaged and unsalvageable.
- Depot operators – daily reports of the exact number of containers in depots is today prone to error since it is performed manually and is time-consuming. Smart Container solutions may enable efficient daily or on-demand remote determination of the container inventory.
- Inland and sea terminal operators - Containers are intermodal by definition, and the terminals are the place where they change transportation modes. Standards-based Smart Container solutions will enable terminal operators to verify the exact location of each container in their yard efficiently, and in real time. Smart container alerts can advise of mishandling or equipment failures or assist in locating dangerous goods to enhance safety. Smart container is one of the technology foundations of smart ports<sup>3</sup>.
- Cross-border Regulatory Authorities (Customs, Sanitary, etc.) - Accurate data about the physical trip of the container prior to its arrival can assist Customs or other Regulatory authorities in more efficiency and improved security when performing risks assessment. Customs Authorities may create a “fast lane” for clearance of Standards-based Smart Container solutions.
- Port Authorities – Planning for infrastructure maintenance and possible improvements well in advance may be aided by long term analyses of smart container data. Real-time smart container data can also be used for reporting to governmental authorities on port usage or to reduce the congestion on the roads and to manage the traffic flow, resulting in reduction of carbon emissions and contributing to an eco-friendlier port environment.
- Banks and Insurance institutions - Institutions related to banking and insurance are heavily involved in the logistics process, from planning and monitoring of contract compliance to post-evaluation of completed routes of transport and transactions. Having additional reliable and timely data from Standards-based Smart Container solutions to support decision-making

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<sup>3</sup> Becha H., Lind M., Simha A., Bottin F. (2020) Smart ports: On the move to becoming global logistics information exchange hubs, Smart Maritime Network, 20/4-2020  
<https://smartmaritimenetwork.com/2020/04/20/smart-ports-on-the-move-to-become-global-logistics-information-exchange-hubs/>

enables smoother operations and more informed risk analyses, mitigation of adverse events and claims settlements. Based on actual data and by post-evaluating completed journeys, banks could grant lower rates to finance supply chains.

The United Nations Economic Commission for Europe (UNECE) Trade Facilitation [White Paper on Real-time Smart Container data](#) for supply chain excellence<sup>4</sup> provides a detailed look into the various benefits of using smart containers as well as the various potential use cases for this technology<sup>5</sup>.

### **The importance of standards for smart containers**

Creating clear, unambiguous message exchange standards are necessary to reap the maximum benefits of the smart containers. Data sharing is particularly important in the logistic supply chain due to the large numbers of diverse players and because container movements are global. Standards-based data models and standard APIs will help stakeholders make the necessary transformation to ensure simplification and acceleration of the integration of digital services from various sources<sup>6</sup>. Standards-based data exchange usage enables open communications channels between supply chain stakeholders increasing and simplifying their collaboration. In addition, it reduces and shares associated data exchange costs, which in turn improves efficiency.

The United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) [Smart Container Business Requirements Specifications](#)<sup>7</sup> (BRS) is the first formal standard that details the smart container data elements. Smart containers' global, multimodal data exchange standards will accelerate adoption of smart container solutions by the logistic chain stakeholders and guarantee interoperability. In fact, smart container standardization effort<sup>8 9</sup> is one of many standardization initiatives<sup>10</sup> supporting global trade. Smart Container standards reduce development and deployment costs and cut time to market for Internet of Things (IoT) solution providers.

### **Future implications for Smart Container adoption**

Digitalization fosters an environment of transparency to support competitiveness on equal terms and enables companies to focus on containing and cutting down logistics and supply chain management costs. Furthermore, standards-based Smart Container solutions offer far stronger capability to deal

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<sup>4</sup> The United Nations Economic Commission for Europe (UNECE) Trade Facilitation White Paper (2019) Smart Containers Real-time Smart Container data for supply chain excellence Version 1  
[http://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers\\_Eng.pdf](http://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers_Eng.pdf)

<sup>5</sup> [http://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers\\_Eng.pdf](http://www.unece.org/fileadmin/DAM/cefact/GuidanceMaterials/WhitePapers/WP-SmartContainers_Eng.pdf)

<sup>6</sup> Becha H. (2019) How Standard APIs Open the Door to Powerful Digital Services  
<https://hananebecha.home.blog/2019/11/28/the-un-cefact-smart-container-project/>

<sup>7</sup> [https://www.unece.org/fileadmin/DAM/cefact/brs/BRS-SmartContainer\\_v1.0.pdf](https://www.unece.org/fileadmin/DAM/cefact/brs/BRS-SmartContainer_v1.0.pdf)

<sup>8</sup> Becha H. The UN/CEFACT Smart Container Project, The magazine of international Institute of Marine Surveying, issue 91, March 2020 <https://www.iims.org.uk/wp-content/uploads/2020/02/The-Report-March-2020.pdf>

<sup>9</sup> Becha H. (2020) Standardization Supporting Global Trade, Port Technology International, Ed. 91  
<https://www.porttechnology.org/editions/shipping-2020-a-vision-for-tomorrow/>

<sup>10</sup> Lind M., Simha S., Becha H. (2020) Creating value for the transport buyer with Digital Data Streams, The Maritime Executive: <https://maritime-executive.com/editorials/creating-value-for-the-transport-buyer-with-digital-data-streams>

flexibly with Supply Chain disruptions (such as we are seeing today) delivering improved resilience. Given these are common goals for all involved actors—be it carriers, shippers, forwarders, governmental bodies or IT and service providers—a collaborative approach becomes the norm for enhanced supply chain visibility, resilience, and analytics.

Standards-based Smart Container solutions provide timely and critical data for future development and optimization of supply chains. Once such data are communicated through international multimodal standard messaging technologies, there are a lot of opportunities for expansion on the usage of smart containers, and this source of timely data will become a necessity.

Thanks to Standards-based Smart Container Solutions, the computer representation of the supply chain will become synchronized with the physical world. Supply chains will become more transparent, reliable, agile, secure, resilient, connected and sustainable.

Smart Container solutions provide one of the missing pieces in the puzzle, if and only if, different actors along the transport chain establish capabilities to take smart containers services into considerations and integrate that in their business operations as well as sharing the data grasped from the smart container with others along the transport chain.

*Note. The opinions expressed herein are the authors' and not necessarily those of their employers or organizations in which they are active.*

#### **About the authors**

Hanane Becha is actively driving smart assets standardization for key industries such as maritime and rail freight. She is currently the Innovation and Standards Senior Manager at TRAXENS and she is also the Leader of the UN/CEFACT Smart Container Project as well as the UN/CEFACT Cross Industry Supply Chain Track and Trace Project. Hanane has received a Ph.D. and an M.Sc. in Computer Sciences from the University of Ottawa and a B.Sc. from l'Université du Québec.

Todd Frazier has 25 years' experience with FedEx in cargo transportation, 20 years of which were in Information Technology. Currently, he is Strategic Project Lead in the U.S. Regulatory Compliance group and is the FedEx Express Accredited Representative to the International Air Transport Association. He has been Chairman of the Cargo Services Conference, the cargo standards formulative body of IATA, since 2009.

Jaco Voorspuij has some 30 years of experience in Transport & Logistics delivering innovative solutions in the most demanding supply chains. Some 15 years have been spent developing global data standards working with various standardization organizations (e.g. GS1, CEN, UN/CEFACT) including smart containers and cross industry Track and Trace projects. He achieved APICS Certified Supply Chain Professional and is currently globally responsible for Industry Engagement Transport & Logistics at GS1.

Michael Schröder has 30+ years of experience in the maritime industry with both an operational and IT background. He has a position of Project Manager eSolutions at Hapag-Lloyd and is representing the carrier in various standardization organizations such as UN/CEFACT, DCSA and SMDG. He is actively promoting Standardization along the Maritime Supply Chain and developed the VERMAS message for VGM reporting as UN/CEFACT project lead.