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Smart box : the shipping container of the future

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SMART BOX
THE SHIPPING CONTAINER OF THE FUTURE

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1   Introduction

With the increase in global trade, container traffic has increased tremendously in the last two decades. Global container movement has surpassed the 700 million mark (UNCTAD, 2018). This signals a definite milestone for the industry, but it poses a significant threat in terms of commercial viability, safety and security of container related operations. The past year has seen an increase in container related incidents onboard container vessels, ranging from fire, collisions and stability issues. From the complexity that arises thereafter, it is therefore imperative to look at how the container industry can be revolutionized, to enhance safety and security.

The container has shaped up the logistics industry to how it is today, but itself has managed to remain constant, and unchanged, withstanding test of time. But with the current wave of digitalization and technological advancement, it is indeed time for the "Box" to morph into a smart unit that is no longer used just to contain goods when they are being shipped from point to point, but also to disseminate crucial information regarding the condition of goods, location, and other critical information, to all the relevant stakeholders involved during that leg of transportation. Such information will be crucial in arranging for onward receipt and deliveries of containers from ports, terminals, consignees to the container depot, in readiness of another journey.

The main discussion should therefore be; how can the container evolve? With the current trend, where there has been the introduction of many technologies and innovations that have taken place and are rapidly changing across all industries, like air transport, automotive industry, why has the container been left behind?

2   The "Smart Box" of the Future

2.1   Self-weighing Technology

The primary challenge to be tackled is the issue of safe weight and the maximum payload of the container and ensuring that shippers stay within specified limits of loading. This is important in not only handling and storage of containers but also critical to the safety of the vessel when in transit. Although the VGM is a big step towards the right direction, it relies on the shipper(s) to

provide the relevant information (World Shipping Council, 2016) including the weight loaded; thus there is still room for manipulation or human error. Thus the need for incorporation of smart self-weighing technologies that can assist in getting the accurate weight of the goods loaded into a container, and transmitting the same information via an LCD screen that can be built into the container, or printed out remotely. The same information should also, on command, be available to all the relevant stakeholders in the shipment, e.g., the shipping line, terminal operators, and exporter, who will need the information for further planning, processing, and documentation.

An excellent example of such a technology that has been tried and tested thus can easily be adapted to the industry is the load cell technology. The technology involves the use of load cells, which are devices that convert pressure or force, into an electric signal, which is then represented as digits on a screen or print-out. Such technologies have been tested on mobile equipment, such as self-weighing vehicles, and also immovable infrastructure, such as storage silos (Cardiff University, 2017).

More research is underway to ensure that the technology involved is not only compact, but self-powering, and can harvest, store and use the energy needed in the most efficient way possible, to ensure the longevity of power supply.

The technology can be built onto the floor of the container, where it may be possible to use thinner and lighter materials such as aluminum panels, in case of the traditional wooden floors.

2.2   Sensor Technology

In the automotive industry, the minimum number of sensors presently varies from around 30 to 60, and according to research, and by the year 2021, a car will have on average, approximately 200 sensors. Sensors are becoming readily available, and affordable, and can be modified to be used to sense and react to sensitive information such as temperature, humidity, shocks and other necessary information, which can then be relayed to a central processing unit, and after that corrective or necessary action is taken. Such technology is becoming more inevitable to the container industry, bearing in mind that goods being shipped are becoming more valuable, sensitive and need constant care and monitoring.

Sensors can be incorporated to: -

1. Monitor temperatures from within and without the container, and notify relevant party if any necessary corrective action needs to be taken, e.g., ventilation, or control temperatures remotely in case of reefer containers.

2. In case of high temperatures that could trigger a fire, then an alarm is triggered to alert the crew to such an occurrence so that immediate action can be taken.

3. Arm container doors, and report on any incidents of unauthorized or forceful opening of doors before sensors are disarmed by authorized personnel.

4. Record any severe impacts, knocks or hits a container may get during transit, to ascertain the responsible party in case of any damage to cargo and the box.

5. Measure and keep track of moist and humidity levels, which may have a serious impact on some cargoes.

6. Report on proximity and location of the container, real time, to enhance tracking and traceability, and also report when the container is loaded or offloaded, received into the yard, or empty container depot.

All this information recorded should then be contained and processed by a central processing unit that can be built into the container. Such data, if properly collected, and analyzed, will be beneficial and valuable not only to the shipper, but also the maritime industry at large.

2.3 Connectivity

With the incorporation of such sensors as mentioned above, there is need to ensure that there is constant connectivity, to facilitate for data exchange between the container, shipper, vessel, ports of loading and discharge, and relevant equipment management center. In instances where there may be several containers shipped as one, i.e., a big lot, then all containers can be synchronized, so that planning is done simultaneous, thus enhance operations and enable proper planning. Such seamless connectivity and data exchange can be facilitated by the Internet of things (IoT) (Da Xu, He, & Li, 2014). IoT can provide for the platform for integration of the information technology. Other technologies to enhance connectivity such as satellite systems and GPS may

be incorporated, to facilitate data and information transfer, and also the global positioning of the containers. IoT will also enhance operations, particularly when there is full integration, and even the transport networks are connected to the ports and the Terminal Operating Systems and Terminal Loading Systems, then there is seamless connectivity across the supply chain.

3   General Safety of the Container

During a voyage, the container is exposed to a series of knocks, both major and minor, and this, over time, takes a toll on the equipment, and may lead to small damages and cuts, or even lead to major defects of the frame or chassis. A simple and inexpensive way to protect against such knocks, and cushion both the container and its contents from significant shock, would be to incorporate thick rubber, along the rails and strategic parts of all the sides of the container, keeping in mind the stability and weight limitations of the box. This will be able to protect the container from all sides and angles from knocks and extend the life of the container. The rubber may be removable and easily adjusted so that when it is worn out, it can easily be replaced.

To counter the increasing amounts of fire, especially on board the vessels, there is need to introduce containers with a fire suppression mechanism. This can be connected to the sensors, and when temperatures reach a certain degree, then the fire suppression agents are released to control the fire and contain it within the box, so as not to spread out and cause damage to the other containers. Fire suppression mechanisms may be of various chemical composition, including inert gases, CO_2 and even water-based, and depending on the commodity carried, then a suitable container will be released to a shipper.

4   **Conclusion**

Technology, through innovation, is rapidly changing the world as we know it, and even some aspects of the maritime industry are adapting to this change. A good example is the advent of autonomous ships, which is fully embracing some of the technology mentioned herein and is promising to be a game-changer in the industry. It is therefore prudent to create a "Smart Box," that will not only conform to the changing trends but will complement the efforts of the industry in providing for much-needed information, rather than just being a tool of conveyance of cargo.

Most information that can be collected with technologies can enhance transparency in the trade, and also improve the safety of the container, and its contents.

Only when the security and safety of the container, its contents, and the vessel are guaranteed, can business become more sensible and rewarding.

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