

EXECUTIVE SUMMARY

Sensing for Modern Logistics

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Executive Summary

Sensing solutions for logistics are diversified to meet the highly customized demands of different clients in different industries.

The goal of the sensing solutions is to provide high transparency and visibility of the process with minimum costs and frustrations.

As shown on the right, the market is fragmented, filled with players offering highly customized solutions supporting logistics at different stages.

Overall, the market will be continuously fragmented without standout standards or comprehensive solutions.

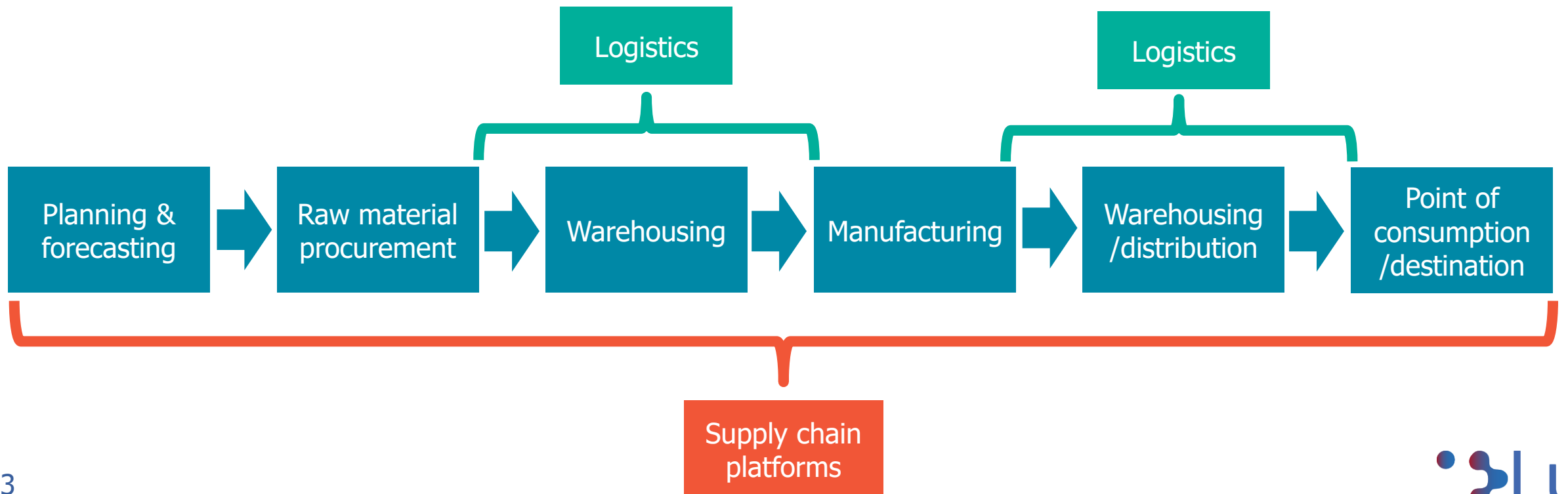
In the meantime, we expect gradual standardization and consolidation of sensing solutions within each industry due to the shared common interests that facilitate the process.

Point of origin	Warehousing	Transit	Destination
●●●● TiHive Tech	●●●● SmartSense	●●●● Sensolus	●●●● Tempix
●●●● Anritsu	●●●● IoTConnect	●●●● Particle	●●●● Cryolog
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	●●●● Wiliot	●●●● Traxens	
	●●●● Impinj	●●●● Nexxiot	
	●●●● Sixgill		
	●●●● Arfidex		

- Right product
- Right quality
- Right condition
- Right place
- Right time

What is logistics?

Logistics is the management of the flow of physical goods and information between the point of origin and the destination. Every stage of the supply chain involves logistics. It can be moving the raw materials, delivering products, or transferring assets between departments. Logistics is an important part of the supply chain that focuses on the temporary storage and transit of goods. As in the example manufacturing chain shown below, logistics plays a critical role in the entire value chain.

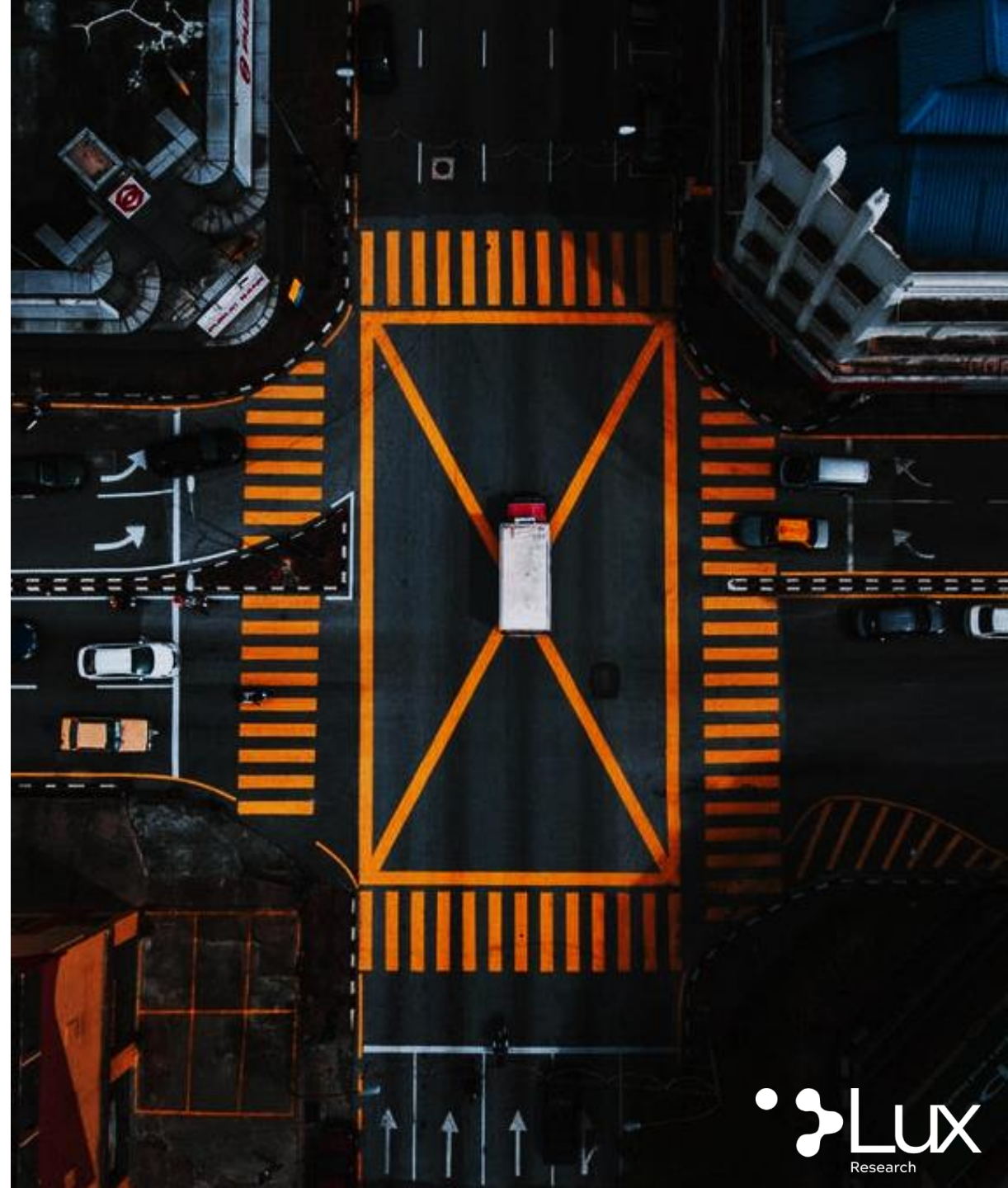


Logistics has been challenging for many industries

Logistics is the bridge that connects supply chains between different sectors. If logistics is not built, maintained, and updated appropriately and on an ongoing basis, movement of raw materials and products will not be smooth and satisfactory, which in turn can drastically impact profit margins.

The ongoing global pandemic has made logistics even more challenging. [Demand patterns have shifted overnight, increased restrictions have been placed on the movement of goods](#), and there is growing demand for close monitoring of goods as they move through the supply chain. These logistical challenges are expected to be exacerbated as vaccines become available for COVID-19. In such a situation, [it is more critical than ever that the right goods are transported](#) in the right quantities, under the right conditions, and delivered to the right place at the right time. Only then will it be possible for society to remain functional and ensure that abundant resources are available to fight the pandemic.

In this report, we discuss how sensing solutions can help address some of these challenges in logistics.

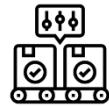


There are several goals to achieve at each of these critical points that can prevent the breakdown of logistics

A logistics process rightly done will get the **right product**, in the **right quantity**, under the **right conditions**, to the **right place**, at the **right time**, to the **right customer**, at the **right price**. However, there are unique challenges at each of these critical points that can impact the efficiency of logistics, sometimes even culminating in a complete breakdown:

Goals to achieve at each point

Point of origin



Ensuring that the right product in the right quantity is prepared for shipment and information is prepared.

Warehousing



Ensuring assets and goods are stored in the right conditions. In addition, keeping track of product location and length of stay in detail can be challenging.

Transit



Ensuring that assets and goods are kept under the right conditions, the journey itself is uneventful, and only desired activities occur at the desired time and place; informing all parties of any time-related changes.

Destination



Ensuring the integrity of the goods after long journeys and gaining evidence that supports liability transfer from transportation carriers to receiving parties.

Using case studies, we highlight how sensors are used in each part of the logistics process to achieve appropriate goals

We briefly introduce the four critical points in logistics. Using eight case studies (in the full report), we discuss key challenges and how sensing solutions can be used to overcome challenges throughout the logistics process. In each case study, we describe:

- The pain points addressed by the sensing solution and the core outcomes enabled by the solution
- The core sensing technology that enabled the sensing solution to improve logistics

The use cases are evaluated using two metrics:

- **Impact on logistics** – Measured in three levels (low, moderate, and high), this indicator measures the relative effectiveness, visibility, and readiness that these tools hold
- **Readiness for adoption** – Measured in three levels (low, moderate, and high), this indicator measures the relative number of companies and the level of adoption

USE CASE	CASE STUDY
<i>Point of Origin</i>	
Inspection and information collection	Fast goods inspection and information collection on conveyers
<i>Warehousing</i>	
Condition monitoring	Coolant gas leak monitoring in cold storage
Flow of assets	Tracking pallets motion in beer brewery warehouse
<i>Transit</i>	
	Real-time location monitoring of returnable transport packaging
End-to-end visibility	Storage condition monitoring during transportation for poultry products
	Utilization, events, and condition logging of railcars
	Real-time tracking of high-value tools
<i>Destination</i>	
Asset integrity confirmation	Using irreversible sensors to reveal the history of goods

Transit



Why it's important

Transit is the step that involves physically moving goods and related information from point A to point B using various vehicles. This step is the most important within the logistics process and usually suffers from low information synchronization.

How sensing solutions help

Sensing solutions can facilitate the flow of information on assets and help stakeholders gain end-to-end visibility.

Challenges

There is a lack of transparency, predictability, and operational agility around continuous changes during transit. These challenges arise due to roadblocks to information flow caused by both technical challenges and human-driven factors.

Use cases

- **Procedural visibility:**
 - Seamless location tracking throughout the process
 - Condition monitoring for high-value goods
 - Improving utilization of capacity
 - Security and control

USE CASE – TRANSIT

Procedural visibility

What it is for logistics

Continuously tracking the movement and condition of the asset throughout the transit process helps companies get real-time intelligence and make timely decisions, thus allowing them to optimize the process.

What it achieves

Right product	Right place
Right quantity	Right time
Right condition	

Pain point

Although asset flow is well managed, managing the flow of information is still clunky and lacking in agility.

Highlight technologies

Location tracking	Condition/event tracking	Both
Using the existing GPS and wireless communication infrastructure to track the real-time location.	Various sensors integrated into devices measure and communicate data. Battery life can be a challenging issue for users.	Combining the two, focusing on function. This is more costly and requires delicate device design to be energy-efficient.

CASE STUDY – SEAMLESS LOCATION TRACKING

Sensolus partners with Airbus to track returnable transport packaging (RTP)

Use Case

Airbus, one of the biggest airplane manufacturers globally, has a complicated logistics system that it uses to ship parts to sites throughout the world. Airbus integrated Sensolus' solution with its IoT platform to provide full location visibility for its assets. Sensolus' GPS trackers offer real-time location data on RTP, as they transit among Airbus' warehouses and international departments.

Key technologies

Sensolus' key technology is its low-power GPS trackers integrated with various sensors. The GPS trackers communicate using Bluetooth Low Energy, Wi-Fi, and Sigfox protocols. By leveraging built-in sensors, the tracker can perform self-calibration and decode the transport environment, such as in-flight, truck, or shipping vessels, thereby allowing it to accommodate various environments.

Key Players



Sensolus and Airbus' use case is special. Airbus' use case only involves Airbus itself as the point of origin and destination, meaning that the company can benefit from the sensor-enabled visibility of asset flow to optimize its logistical efficiency, container utilization, and crew agility without worrying about returning the devices.

TRANSIT

Summary

Sensor solutions for transit are diversified by solutions rather than by the basic technologies. Despite the importance of using emerging sensor technologies to achieve affordable, stable, and long-lasting solutions, they only overcome data entry challenges. The players in the market offer solutions optimized for target applications. The solutions are usually unique and do not overlap with their competitors' offerings.

LUX TAKE

The fragmented market is both beneficial and detrimental. For solution providers, such a market is easy to penetrate. On the other hand, the lack of comprehensive and standardized platforms increases the costs, especially when multiple pain points need to be tackled. Furthermore, despite the importance and readiness of the technologies, the market may show some hesitation and frustrations.











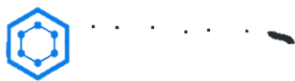



Importance to logistics



Readiness for adoption



Highlight players

Location tracking	Condition/event tracking	Both
		
		
		
		
		
		

Sensing solution providers offer different solutions based on their use cases of focus

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Outlook

The market will remain fragmented, with increasing diversified solutions

Diversified requirements and asset types will keep the market fragmented and filled with industry-specific sensing solutions. Furthermore, maturing sensor technologies will motivate innovations in emerging solutions to address unmet demand and untackled pain points. This will introduce more diversified solutions.

Consolidation will occur within each industry sector

Although the market will become more fragmented, within each industry, we expect consolidation to occur for two reasons: 1) availability of mature and low-cost sensor technologies, and 2) it will be easier to identify shared demands and issues.

Sensing solution providers will focus more on analytics

Sensor-collected data tells what happened during the logistics processes, but analytics reveals the root cause behind the events. Sensing solution providers will develop analytics for their sensing solutions, but the process may be slow for small companies due to their slow market penetrations.





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