THE PHYSICAL INTERNET

RETHINKING LOGISTICS

Eric Ballot, Professor
Mines ParisTech – PSL Research University

The Consumer Goods FORUM

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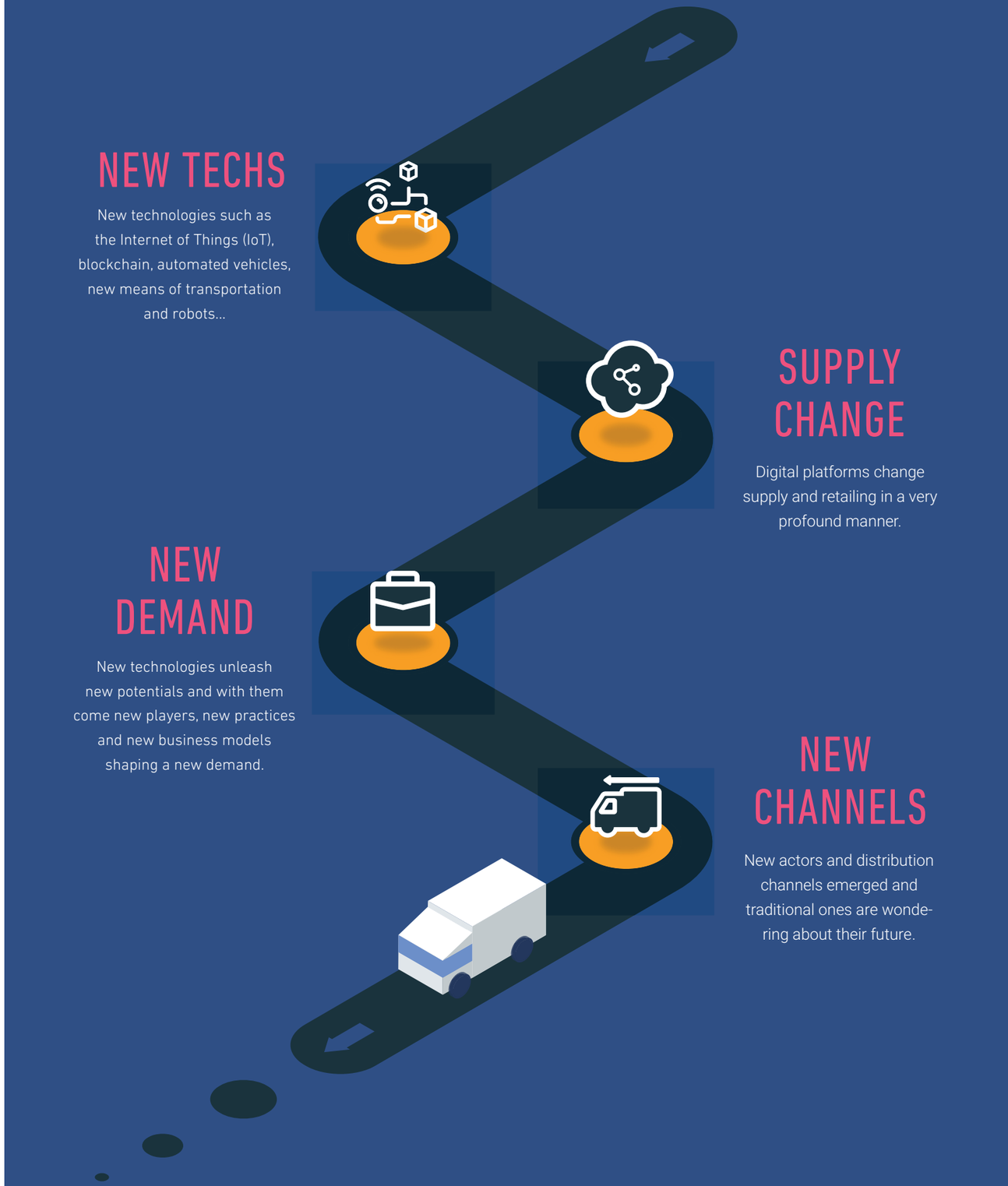
THE FMCG INDUSTRY AT THE FOREFRONT OF AN EVERCHANGING WORLD

INTRODUCTION

The transformation of the economy is fuelled by fast-paced **new technologies such as the Internet of Things (IoT), blockchain, automated vehicles, new means of transportation and robots,** amongst others. Internet and mobile apps not only allow for information to be more accessible but they ultimately change supply and retailing in a very profound way. New technologies unleash new potentials and with them come **new players, new practices and new business models shaping a new demand.**

The demand is also changing at a fast pace. Consumer needs are evolving to incorporate new dimensions such as accuracy, omnichannel, social responsibility and sustainability on top of performance, quality and availability. Products must be, as well as affordable, available when and where the consumer needs them. This transformation has an unprecedented impact on the distribution channels and on organisations. And while new actors and distribution channels are constantly emerging, the traditional ones are uncertain about what the future holds.

In this paper, produced for The Consumer Goods Forum (CFG) and its End-to-End Value Chain Learning Series, Eric Ballot from MINES ParisTech shares a framework for efficient logistics, explaining the current situation and what the potential of applying this framework could mean for the industry.



CURRENT SITUATION

With the new challenges, existing organisations are reaching their limits. On one hand, **web-based retailers capture their consumers online and they then attempt to secure them with high speed delivery.** The associated increase of delivery frequency contradicts the consolidation efforts and jeopardises sustainability. On the other hand, **brick-and-mortar players hold in-store inventories everywhere. but they are often unable to make them available to consumers on the web.** Similarly, producers are struggling to deliver via the numerous channels with different requirements, and omnichannel concepts try to solve the paradox by mixing approaches.

Services are delivered but with several inefficiencies along the way, as most efforts are allocated to improve the final service. From mass production to just-in-time and one-hour home delivery, there is a constant trend towards a disintegrated level of supply. Each player battles with an ever-increasing fragmentation of flows and despite the efforts made by logistic service providers and carriers to aggregate flows that will minimise inefficiencies, they are still very much present. How would energy efficient trains be used when in most cases trucks are currently difficult to fill? Is shifting to drones really the answer when the importance of economies of scale is well-known in transportation?

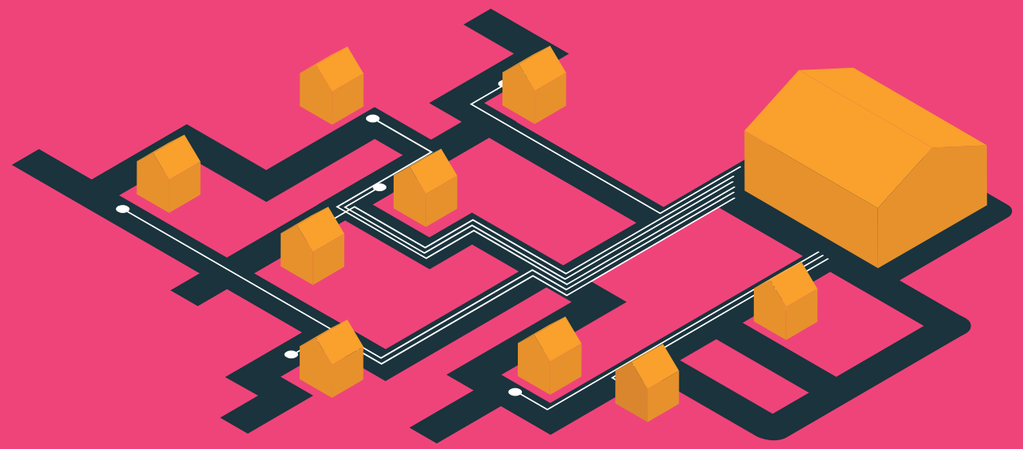
According to research, trucks only have around 50%[1] utilisation capacity. At EU level, this represents around **2 billion euros** per year and per percent of increased fill rate. It also has a significant impact on congestion, the environment, health issues as well as an inflated cost in the infrastructure required to cope with the demand. And transportation is only the tip of the iceberg, **increasing demand for warehouse space during peak consumption, duplication of detours and security stocks are,** among others, clear indications that a framework for efficient logistics is required.

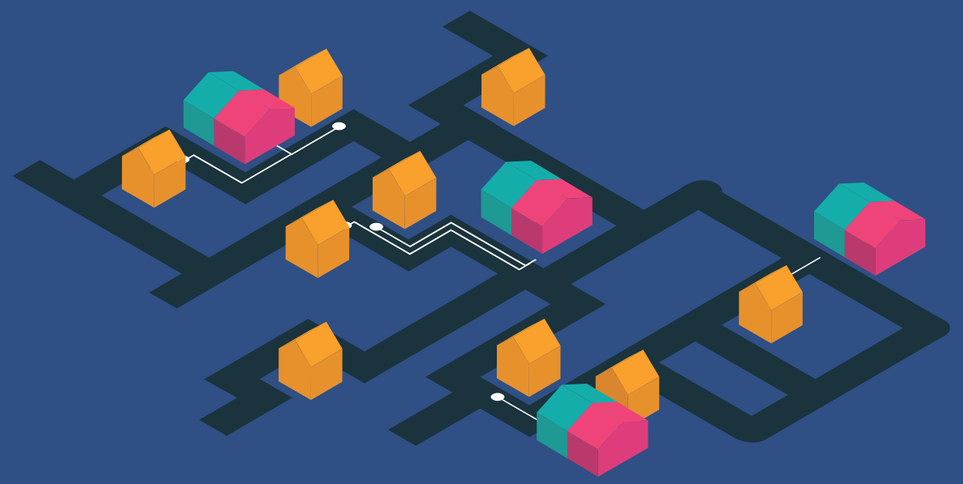
1 Utilisation rate = Fill rate (65%) x Not empty distance (80%)

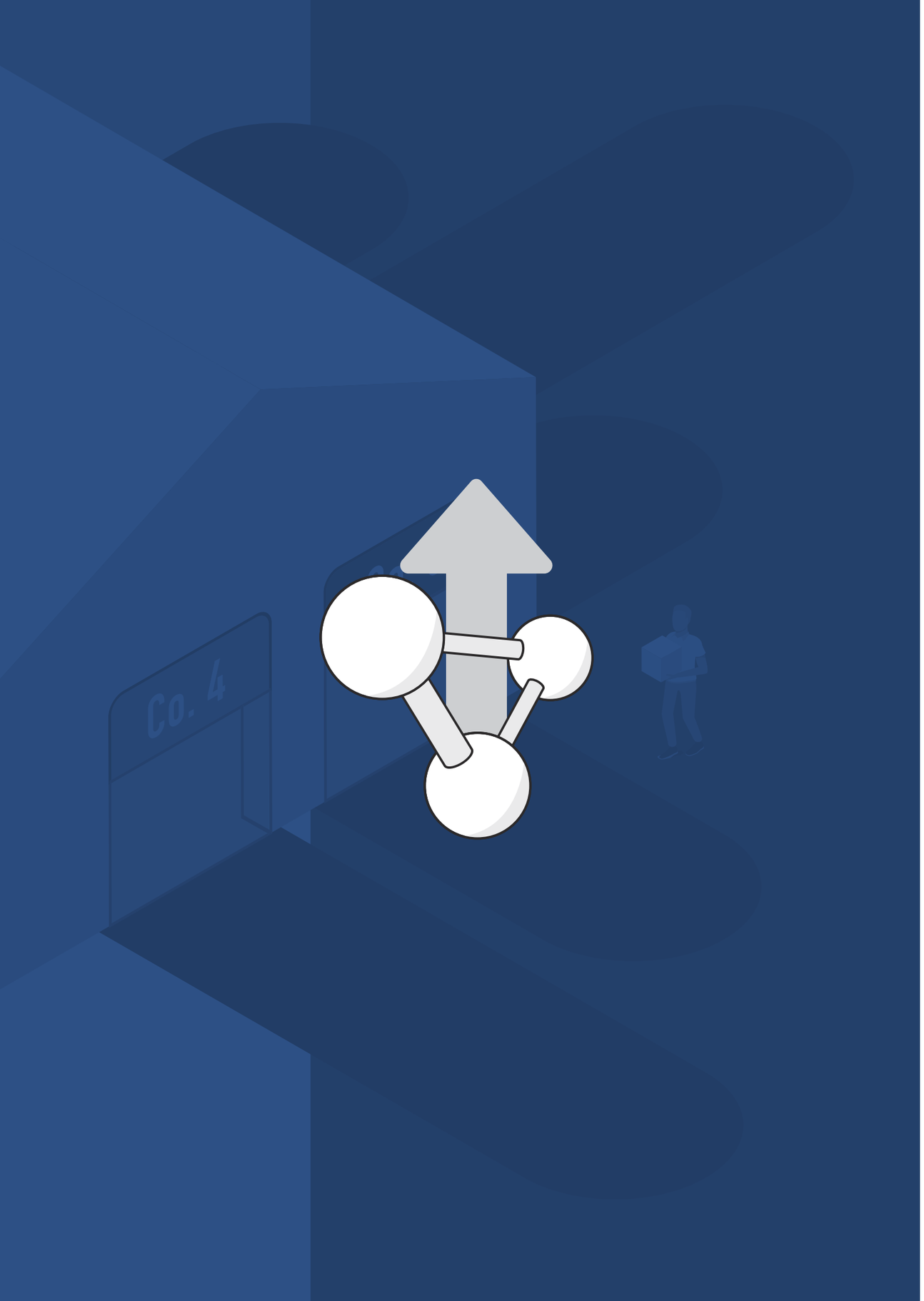
PARTIAL ANSWERS

Given the situation, several responses have been delivered and gradually implemented, namely sub-contracting and third-party logistics, or alliances and sector consolidation. **More recently, pooling/horizontal collaboration is the new alternative solution to the issue of fragmentation.** Collaborative organisations have proven their effectiveness (improved fill-rate, delivery frequency or cost reduction) but are still insignificant in the inland freight and logistics market share. This is due to several reasons, such as the fear of losing competitive advantage and the lack of agility or complexity.

How could these limitations be overcome? **This document is based on the hypothesis that dedicated and fragmented organisations are strong limitations to more efficient logistics.** Therefore, these organisations should be adapted to incorporate the ability to share resources that will ultimately define a new playground for the competition.







A FRAMEWORK FOR EFFICIENT LOGISTICS: PHYSICAL INTERNET

Dedicated computer networks developed by numerous technologies, and there was a need for better communication links between them. **As a result, the digital internet developed a universal suite of interconnection protocols (TCP/IP).** These protocols enable every single network to work with others in a seamless manner. The internet is technology independent, scalable and resilient and the progress it has made in the past years has surpassed expectations.

This is why the **End-to-End Value Chain Pillar of the Consumer Goods Forum** is also basing its newest development on the internet such as Interoperability (OpenAPI) and the Learning Series (Internet of Things, Simple Links).

How could these internet principles be applied to the field of logistics?

This is the core question that is being investigated by Benoit Montreuil, Russell D. Meller and Eric Ballot along with experts from major Fast Moving Consumer Goods (FMCG) companies and institutions. Comprehensive definitions already exist[2] but the essence is the universal interconnection of logistic services. In freight traffic for example, **bilateral exchange agreements are in place in express or maritime services** and national postal networks are also interconnected between themselves thanks to the Universal Postal Union (a UN agency) but strictly limited to specific services. The goal for the supply chain is to make logistic services **accessible to all players in a seamless manner by sharing resources,** i.e., the competition will move from owning assets to smart exploitation of potentially all assets.

In a recent European project[3], interconnected logistics were experimented by a P&G plant in collaboration with Poste Italiane for the distribution of goods.
An experimental interconnection of the 3PL Jan de Rijk was required to make this happen. Was it worth it?

2 Ballot, E., B. Montreuil, and R.D. Meller, The Physical Internet: The Network of Logistics Networks. 2014, La Documentation Française, Paris.

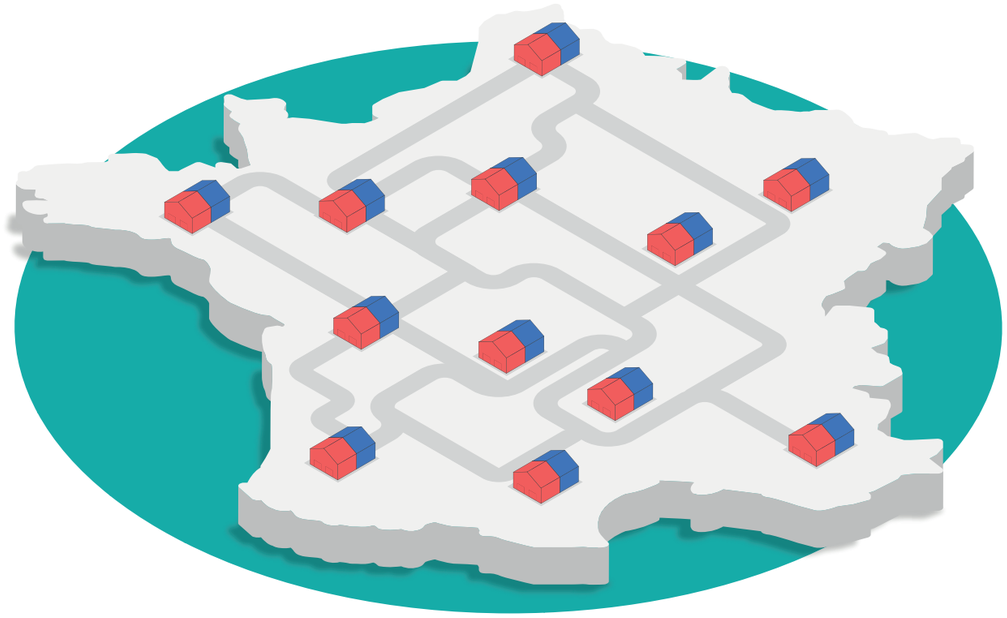
3 Modulushca, FP7 EU project.

THE POTENTIAL OF INTERCONNECTED LOGISTICS

It is challenging to measure the potential of a system that does not yet exist. However, a simulation tool can be used to measure the potential next steps. Although this approach is not entirely representative of potential and organisational limits, it can provide some interesting insights.

A few years ago, a **simulation model was built by two major French retailers (● Carrefour and ● Casino)** and their main food, beverages and personal care suppliers (from plants to regional distribution centres). The underpinning question behind this tool was to use a physical internet system rather than dedicated services to supply actual demand. The task involved a few years' participation of several academics and it achieved positive results. The complete network of logistic flows was gradually changed to interconnect them. The simulation model resulted in a network of **50 hubs to serve the French territory rather than dedicated warehouses.** The orders were loaded into containers of modular sizes and progressively routed towards consignees at the same time, each one following its own route with its own service level and priority.

To use a physical internet system rather than dedicated services to supply actual demand.

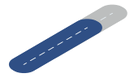


SOME FACTS

The results are remarkable. Direct shipments reduced their distance travelled by 15% compared to current hubs and spokes. Decentralized stocks (which are managed virtually as one), drastically reduce safety stocks while at the same time, shared delivery reduces transportation costs.

The reduction by a factor of two in logistic costs is dynamically computed for the same or improved service level. The modal shift from trucks to trains on major lines **reduces greenhouse gas (GHG) emissions by 60% while increasing the fill rate from 65% to more than 85%.** Thus, there is potentially around **40 billion euros yearly** (all sectors at EU level) in direct cost reductions.

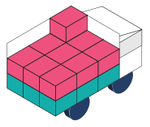
Additional figures are available in different reports but they only represent a small-scale of the potential. **All costs are taken from actual operations and could be improved by automation** or by economies of scales should a new system emerge, without even mentioning innovation in systems and services.



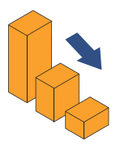
-15%
distance travelled

STOCKS LEVEL
-40%

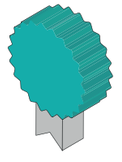
-60%
GHG emissions reduction



FROM 65% TO 85%
fill rate



REDUCED TRANSPORTATION COST



SAME OR IMPROVED SERVICE LEVEL

A NEW CONCEPT FOR LOGISTICS: PHYSICAL INTERNET

PHYSICAL INTERNET: THE THREE MAIN TECHNICAL AXES FOR DEVELOPMENT

PHYSICAL TOOLS

Several aspects must be addressed in the development of the framework: physical, informational and processes.

Like computer networks, logistic operations will require physical components to ease the switch from one service to another. In an interconnected network, it is vital to protect privacy and to improve handling. To ensure this, two levels of containerisation are distinguished:

1. Transportation containers:
Adapted to one or several means of transportation (i.e. the maritime container), that act as the interface between the transportation means and the protection of the cargo.

2. Handling containers:
They contain the goods with modular dimensions to efficiently fill any kind of transportation means/containers.

The underlying idea is to handle the containers rather than the products themselves. This would allow for a standardised set of containers to travel as far as possible in the supply chain, minimising additional handling. This would also allow for a progressive removal of pallets as shipped quantities reduce.

Directing boxes from one provider to the next will require sorting as well as aggregation and disaggregation processes. This could become an issue should many handlings take place during the journey of a box, despite simulation results suggesting otherwise. Handling boxes is not always easy to manage, but it could improve with standardisation and new handling devices. The best example can be taken from the shipping container, which divided the cost of handling by ten since its introduction. **And, should this approach be used for inland supply chain,** the use of transhipments would be the norm rather than the exception. Boxes would be sealed to increase security but full traceability will have to be provided to ensure a new level of traceability and trust.

INFORMATION TOOLS

Moving containers and modular boxes worldwide require that all stakeholders accurately capture, code, secure and transfer information and although several solutions currently exist, they are not all fully implemented.

Data capture will not only have an impact on logistics, but it is a solution that is already underway with the **Internet of Things.** With developments of sensors and communication devices. It implies almost real time full visibility on all assets regardless of the logistics operator.

Having a universal language or a common vocabulary, such as the EPCglobal® Network will allow for efficiency and will enable seamless communication between applications and objects such as Simple Links. The data will be clear and understood in the exact same way all along the supply chain.

Secure information sharing is also an issue for logistics and there is an opportunity **to build on technologies such as APIs or blockchain** to transfer and record all interactions, without compromising business confidentiality.

PROCESSES

The real engine will be the new processes.

At operational level, routing containers imply the selection of the best service proposal at all levels of the supply chain to achieve a given objective. Taking the example of a hub near a city, a container that is due to be delivered at the city centre could verify the availability of an improved service to arrive to its destination. A set of requests would subsequently be sent to the hubs near the city. In parallel, the carrier could submit prices for containers to load in the same hubs. Should an agreement be reached, the carrier would deliver at a hub the containers to the city centre and load new ones for the next destination. This kind of mechanism design could result in a new level of coordination at different planning stages to make better use of all logistic assets while ensuring same service levels.

The processes are not only applicable to transportation. If the network is shared, it enables to store containers (i.e. products) in all accessible locations. Rather than rushing from one centralised warehouse to customers, **the containers could be repositioned gradually from one hub to the next, on the way to the customer.** Recent research suggests that decentralized inventory management can pool all stocks to reach high service levels without dedicated safety stocks. Up to 40% of stock reduction is envisioned for the same or improved service level with no increase in transportation costs.

These are only a few examples of new operations enabled by open and shared logistic networks. **Many other options are foreseen, such as improved product availability, logistics network resilience or physical internet access provider** (similar to internet access provider) to improve home delivery to a whole new level, thanks to a decentralised but highly connected and trusted organisation.

TRANSPORTERS

According to a predefined route, a transporter seeks to improve it by avoiding detours and adding extra cargo in hubs

SC MANAGERS

If the network is shared, it enables to store containers not only in s single location. Instead of rushing from one centralised warehouse to another, the containers could be repositioned from one hub to another

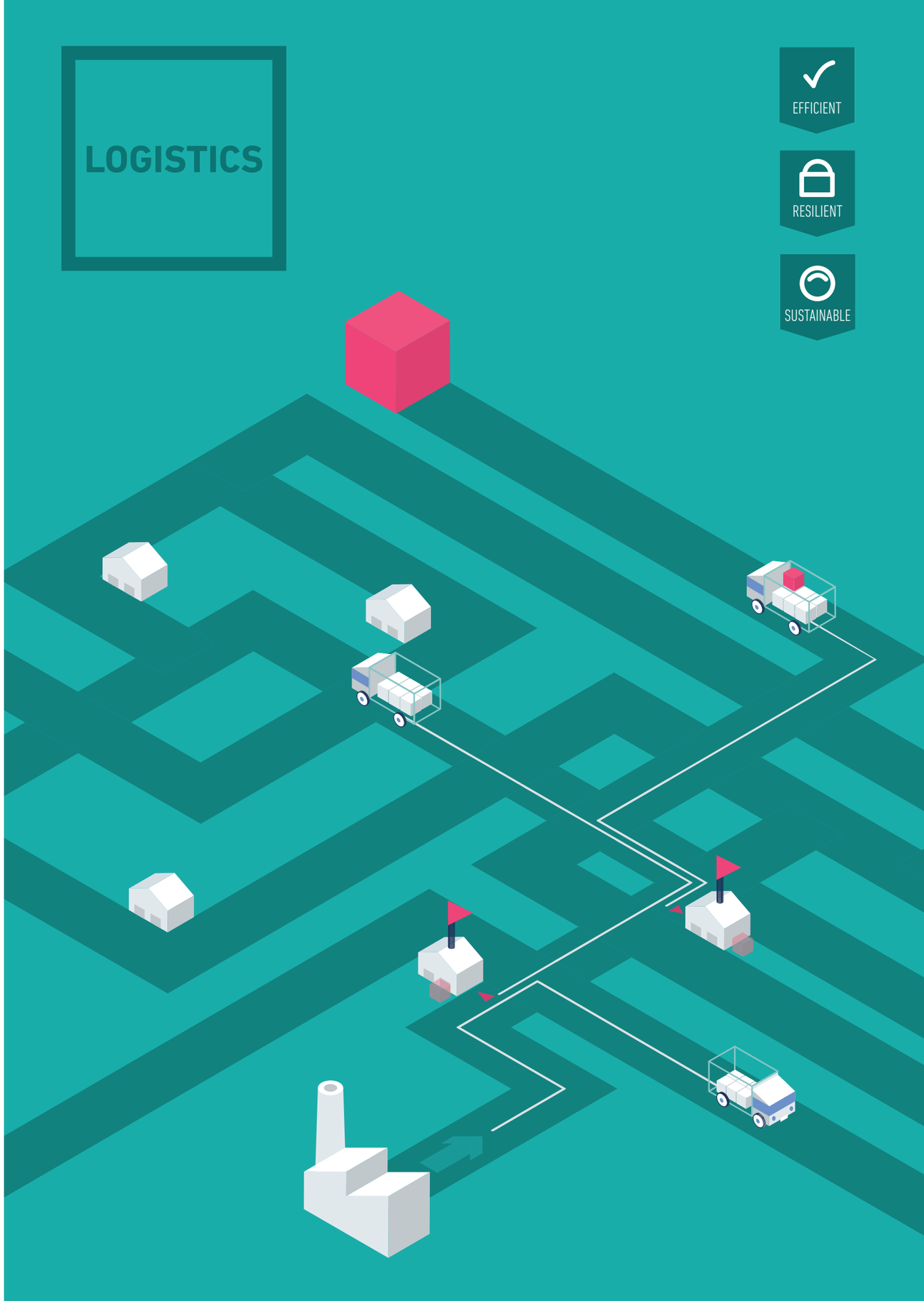
HOW TO GET THERE?

Physical Internet is a new concept coined in 2011 and made public in 2014. The aim of this concept is to organise logistic activities with much more potential than how it is currently done, which was inherited from mass production and distribution **to cope with new demands.**

Despite the concept being new, it has gained the attention from thought leaders in Europe, North America and Asia. In Europe, there is now a European Technology Platform named ALICE ETP which brings together more than 100 members (LSP, manufacturers, retailers, IT, labs, ports). ALICE, is responsible for the research roadmap towards the Physical Internet in 2030. **For more information, please visit www.etp-logistics.eu.**

In parallel, some companies launched services that could be premises of the Physical Internetsuch **as transportation web platforms and warehouse as a service platform.** New freight marketplaces, warehouse as a service, and software offers are also expanding with traceability applications, mixing cargo planning or hub operations with a couple of routing centres, not to mention network offers from front runners' players. These start-ups and new operations are clear examples of the trend and potential benefits it could have on actual operations. **The true potential will only be reached when agreements on neutral protocols can be reached.**

The next steps will require the development of the Physical Internet Protocols Suite to enable the generalisation of much more efficient, resilient and sustainable logistics. This new level will not be achieved without the collaboration of the major players and their representatives in each sector.



About The Consumer Goods Forum

The Consumer Goods Forum ("CGF") is a global, parity-based industry network that is driven by its members to encourage the global adoption of practices and standards that serves the consumer goods industry worldwide. It brings together the CEOs and senior management of some 400 retailers, manufacturers, service providers, and other stakeholders across 70 countries, and it reflects the diversity of the industry in geography, size, product category and format. Its member companies have combined sales of EUR 3.5 trillion and directly employ nearly 10 million people, with a further 90 million related jobs estimated along the value chain. It is governed by its Board of Directors, which comprises more than 50 manufacturer and retailer CEOs.

For more information, please visit: www.theconsumergoodsforum.com.

Author

Eric Ballot

MINES ParisTech,
PSL Research University
Centre de Gestion Scientifique - I3 - UMR CNRS 9217, Paris, France
60, Boulevard Saint-Michel
75272 Paris Cedex 06, France

eric.ballot@mines-paristech.fr