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16 – 19 SEPTEMBER 2025

2025 PHARMA LOGISTICS MASTERCLASS WHITE PAPER

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01. EXECUTIVE SUMMARY

Since its launch in 2021, the Pharma Logistics Masterclass (PLMC™) has evolved into a global reference point for executive education and collaboration in life sciences logistics.

Developed by Pharma.Aero and the University of Antwerp, the Masterclass bridges the worlds of business and academia, offering a unique platform where industry leaders, researchers, and policymakers co-create knowledge, exchange expertise, and address the most pressing challenges in pharmaceutical and medtech supply chains.

Pharma Logistics Masterclass 2025: Japan Edition

Held in Osaka and Kyoto, the 5th edition of the Pharma Logistics Masterclass marked another major milestone in this global journey of education and collaboration—combining academic depth with practical immersion.

Participants engaged in C-level strategy workshops, academic keynotes, and industry site visits that provided real-world insights into Japan's world-class logistics ecosystem.

The final day took learning "beyond the classroom," featuring a visit to the World Expo Osaka and a farewell dinner at the BelExpo Pavilion, celebrating cross-cultural exchange and future-focused collaboration.

This White Paper presents a comprehensive overview of the lectures, presentations, and workshops that shaped PLMC™ 2025, along with the main highlights and key takeaways that define the state and future of pharmaceutical logistics.

Looking Ahead

In 2026, the Pharma Logistics Masterclass will take the next step in its global evolution—expanding across two cities and two countries, hosted in Frankfurt, Germany, and Antwerp, Belgium.

This next-level edition will continue the Masterclass mission of bridging business and academia, driving innovation, and fostering global collaboration in the life sciences logistics sector.

For more details and registration, visit **www.pharma.aero**.

Organizing Committee

Prof. Dr. Roel Gevaers

Mr. Frank Van Gelder

Prof. Dr. Wouter Dewulf

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02.
DAILY HIGHLIGHTS AND TAKEAWAYS

DAY 01

Day Chairs:

Laetitia Chery, JAS
Prof. Dr. Roel Gevaers, University of Antwerp

Key Topics

- **Market Trendsetters & Future Outlook**
- **The Value Chain Strategy**

Learning Objectives ↗

- Understand emerging trends within the healthcare ecosystem that are shaping the life sciences Value Chain 4.0.
- Evaluate and discuss global flows and developments in the pharmaceutical and medtech manufacturing industries and their impact on supply chain and logistics
- Understand how healthcare providers respond and adapt in an ever-changing landscape of uncertainty and crises
- Identify and assess key impact factors—such as economic imbalances and geopolitical tensions—that influence business strategy
- Develop and execute a strategic plan in a real-time business case scenario, collaborating with C-level executives

Setting the Scene: Supply Chains & Healthcare Innovations Cross-Pollinate to Spark the Future

Prof. Dr. Roel Gevaers, University of Antwerp
Frank Van Gelder, Pharma.Aero

The introduction of PLMC 2025 depicts the healthcare and pharmaceutical supply chains undergoing a profound transformation.

From the pandemic's $16 trillion economic shock to the pressures of an aging and expanding global population, healthcare systems now face rising demand amid geopolitical instability and climate change.

At the same time, the sector is moving toward individualized medicine, gene therapies, and preventive care, supported by AI-driven research, digital health technologies, and the Internet of Medical Things (IoMT). These advances are not only reshaping clinical practice but also redefining how medicines and therapies are developed, manufactured, and delivered.

Sustainability, accessibility, and patient-centricity are becoming foundational principles, with innovations such as decentralized manufacturing, real-time plant connectivity, and continuous monitoring setting new operational standards.

For supply chains, these shifts translate into new business models and logistical challenges.

The "Amazonization" of healthcare is driving a transition from B2B to B2B2C, accelerating direct-to-patient deliveries while demanding more secure, traceable, and resilient logistics networks.

High-value pharmaceuticals and biologics require specialized handling and transport, while distributed production and additive manufacturing reduce dependence on centralized hubs.

Artificial intelligence, robotics, and digital twins are transforming manufacturing and logistics ecosystems —turning linear chains into integrated, intelligent, and sustainable networks.

Looking toward 2035, personalized medicine is projected to become a trillion-dollar market, with e-commerce platforms fully integrated into healthcare delivery.

Yet persistent gaps in skills, infrastructure, and digital access, particularly in low- and middle-income countries, risk widening inequalities in global healthcare access.

Setting the Scene: Supply Chains & Healthcare Innovations Cross-Pollinate to Spark the Future

Key Takeaways ↗

Ecosystems, not firms, compete:

Platform players reshape pharma logistics data, visibility and consumer interfaces; control towers must evolve into decision-centric “command towers.”

Distribution model shift:

Push➜pull, B2B➜D2D, pallet➜parcel; direct-to-patient models expand.

Modal optimisation:

Selective sea-shift for stable categories while preserving air for speed- and integrity-critical lanes.

Operations 4.0:

Decentralised manufacturing, AI-driven analytics and “always-on” connectivity to reduce downtime and stockpiling.

Risk and ethics at the core:

Geopolitics and regulatory friction directly affect availability and cost; proactive compliance and network optionality are essential.

When Tariffs Rise and Geopolitics Shift, the World's Trade Winds Change Course

Prof. Dr. Seçkin Özkul, P.E. – Muma College of Business South Florida University

Global pharma supply chains are increasingly shaped by geopolitical tensions, trade disputes, and tariff policies that alter the flow of medicines and raw materials. The U.S., Europe, and Japan play a central role as both importers and exporters, but their heavy reliance on active pharmaceutical ingredients (APIs) from Asia, especially China, creates significant vulnerabilities. When trade conflicts or regional crises disrupt production and transport, ripple effects are felt worldwide. Events such as the U.S.–China tariff clash, the Russia–Ukraine war, and tensions in the Taiwan Strait have not only raised costs but also increased uncertainty, forcing companies and governments to rethink sourcing strategies and logistics operations.

Pharma supply chains are particularly exposed because timing, quality, and reliability are critical, and the sector depends heavily on air cargo. Rising tariffs increase costs throughout the chain, affecting manufacturers, distributors, and ultimately patients.

To cope, firms are diversifying suppliers, exploring nearshoring options, and shifting from "just-in-time" to "just-in-case" inventory strategies. Governments in regions like the EU are also advancing stockpiling policies for essential medicines. At the same time, digital innovations such as AI-based forecasting, digital twins, and real-time dashboards are being adopted to anticipate disruptions and support agile responses. In this environment, volatility has become the norm, and resilience, flexibility, and foresight are essential to safeguarding the steady flow of medicines across borders.

Key Takeaways ↗

Tariffs = cost + delay:

Expect higher landed costs and potential dwell time at borders; design buffers accordingly.

Decoupling exposure:

Heavy API and generics dependence on Asia (40% of API sourced from China and India) requires alternate sourcing footprints and route optionality.

Anchor-market vulnerability:

US/EU/JP disruptions ripple globally; scenario plans should address 12–48-month turbulence.

When Borders Blur — The Global Healthcare and Pharma Market

Vincent Van Bockstaele, University of Antwerp

Japan's healthcare demand is structurally high due to rapid population ageing and exceptional life expectancy, making it the world's third-largest pharmaceutical market and a top healthcare spender by share of GDP.

Ageing Drives Demand

Japan's ageing population fuels growth in cancer, dementia, and chronic disease treatments.

Imports Dominate Supply

High-value medicines, especially biologics for elderly care, are increasingly sourced from Europe/US.

Fragile Supply Chains

Supply chains are fragile, concentrated, and exposed to global shocks.

Logistics = Healthcare Backbone

Cold chain, airports, and supply security are critical for Japan's healthcare future.

Diagnostic capacity is unusually dense, and R&D intensity is strong. However, stringent pricing regulation compresses top-line revenues, forcing efficiency gains. Domestic pharmaceutical consumption is stable and predictable, yet the value mix is shifting: biologics, blood products and cell/cell-gene therapies are expanding rapidly.

Japan's local production lags consumption, widening an import gap and reinforcing reliance on international logistics, predominantly air freight, for high-value, temperature-controlled products.

Import exposure is concentrated in a few European origins (Belgium, Ireland, Switzerland), while volume growth from East/Southeast Asia (notably China, Korea, Thailand, Indonesia, Vietnam) indicates gradual source diversification. Net effect: a high-value but fragile inbound supply chain where temperature control, lane optionality and capacity assurance are critical.

When Borders Blur — The Global Healthcare and Pharma Market

Key Takeaways ↗

Stable demand, shifting value:

Consumption is steady, but innovative modalities (biologics, blood and cell therapies) are the growth engine.

Import-dependent and aviation-centric:

Production shortfalls mean rising import shares and reliance on air for high-value, time/temperature-sensitive flows.

Concentrated origins, rising Asia volumes:

High-end imports cluster in Belgium, Ireland and Switzerland; generics/low-value volumes increasingly come from regional Asian hubs.

Margin pressure → efficiency:

Government price controls constrain revenue; cost and productivity programmes are essential.

Risk posture:

Network fragility stems from import reliance, cold-chain complexity and origin concentration; necessitating redundancy, multimodal options and robust quality systems.

Crises Don’t Just Challenge Healthcare — They Reshape Its Future

Prof. Dr. Maurizio Cecconi, Humanitas University Milan

The European COVID-19 experience illustrates how crises redefine healthcare delivery and logistics. In Lombardy, early ICU cases forced rapid capacity creation: operating/recovery spaces repurposed, teams retrained, and safety protocols (donning/doffing “safety officers”, 12-hour PPE cycles) institutionalised to protect staff and patients amid supply-chain shortages.

Regional ICU networks pooled beds and data, enabling patient load-balancing and real-time projections that informed government restrictions during exponential surges. Communication pipelines; editorials, live scientific webinars and society-led briefings, were used to counter misinformation and accelerate international preparedness.

At the workforce level, a European crash-course (C19SPACE) trained tens of thousands rapidly, blending online modules with VR-assisted practice. External evaluation indicated improved confidence, knowledge gains and scalable surge capacity at compelling ROI. Clinically, the crisis reinforced disciplined, evidence-based practice (“first, do no harm”), privileging high-quality trials and living guidance (e.g., timing of steroids) over ad hoc interventions.

Strategic lesson: preparedness is an investable capability, codify safety, data sharing, surge planning and cross-border training now to reduce future morbidity, mortality and system stress.

Key Takeaways ↗

Capacity at speed:

Repurpose spaces, pre-train cross-functional staff, and formalise safety roles to protect teams when PPE and devices are constrained.

Networked resilience:

Regional ICU bed-sharing and simple, shared indicators support timely policy action and reduce triage risk during exponential growth.

Preparedness as training:

Scalable, standardised surge training (e.g., C19SPACE) boosts readiness and offers attractive returns on investment.

Evidence over impulse:

Use trial platforms and living guidance to avoid harmful therapies and focus on interventions proven to improve outcomes.

Supply-chain realism:

Expect bottlenecks (PPE, oxygen delivery, transport frictions), plan for inventory governance, substitution protocols and transparent communication.

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C-LEVEL STRATEGY WORKSHOPS

CEO WORKSHOP

Prof. Dr. Koen Vandenbempt, University of Antwerp

Innovation in resource-constrained organisations depends heavily on ownership models, which shape tolerance for risk, accountability, and the speed of decision-making: private-equity environments demand short-term results, while family firms prioritise generational continuity.

Companies must distinguish between revenue streams that deliver genuine competitive advantage and those sustained only by cost control, as even strong performers face erosion under competitive and regulatory pressures.

With fresh capital rarely available, operational efficiency through lean practices, disciplined procurement, energy savings, digitalisation, and centralisation, becomes the main funding source for new initiatives, though freed resources are often pulled back into routine operations. A useful lens frames innovation by market advantage and time-criticality, recognising that experiments only create value when deliberately scaled with proper legal, HR, and operational support.

Effective budgeting therefore spans three horizons, from short-term ROI to long-term learning milestones, while avoiding the trap of devaluing innovations by offering them for free to protect existing customers.

CFO WORKSHOP

Prof. Dr. Wouter Dewulf & Vincent Van Bockstaele, University of Antwerp

Rising tariffs have disrupted the long-standing European pharma model that concentrated margin in low-tax jurisdictions (e.g., Ireland) via limited-risk distributor (LRD) set-ups and high transfer prices.

When import duties are imposed at destination (e.g., 15%), the LRD, being the importer of record, absorbs the duty on the intra-group transfer price, compressing consolidated margins if costs cannot be passed through. Advanced pricing agreements (APAs) and stock-listed governance constrain rapid repricing, limiting tactical flexibility.

A structural mitigation is to split physical goods from intellectual property (IP) licences: invoice the tangible at a lower value (duty-bearing) and charge IP as a service (non-tariffed), noting evidentiary requirements and multi-year transition horizons.

VAT cash-lags (≈45 days) further raise working-capital cost unless bonded regimes are used. Net effect: the same fiscal constructs that once optimised taxes can now work against competitiveness under tariff shocks.

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CTO WORKSHOP

Dr. Jean Metz & Frank Van Gelder, Pharma.Aero

A CTO's role embodies the complexity of leading innovation while safeguarding stability, requiring not only technical mastery but also strategic foresight and people-centred leadership. Acting as the guardian of digital solutions such as supply chain monitoring, the CTO must ensure technology remains a useful servant rather than a dangerous master.

The challenges were illustrated through escalating role-play breakouts: first, managing a situation where a key client identified problems before the company did, testing accountability and responsiveness; second, facing sudden regulatory changes that forced cloud hosting migration, highlighting the need for agility and compliance; and third, coping with the organisational fallout of cost-cutting, where the resignation of key AI/ML engineers posed risks to talent retention and knowledge continuity.

Across these scenarios, success hinged on conviction, awareness of stakes, quick decision windows, and effective influence levers, showing that the ideal CTO is not just a technologist but a resilient strategist who protects reputation, anticipates risks, motivates teams, and ensures technology serves long-term organisational and societal goals.

COO WORKSHOP

Prof. Dr. Roel Gevaers & Rafael Arrevalo-Ascanio, University of Antwerp
Prof. Dr. Seçkin Özkul, P.E. – Muma College of Business South Florida University
Prof. Dr. Bill Eisele, Texas A&M Transportation Institute

Pharma logistics faces a unique set of challenges that demand precise coordination and forward-looking strategies.

Ensuring reliable transportation, managing inventories of short shelf-life products, maintaining cold chain integrity, and preparing for risks such as disruptions or regulatory shifts are all critical elements.
Performance is often measured through indicators like on-time delivery, inventory turnover, cold chain compliance, resilience indices, and carbon emissions. Traditional forecasting methods, while useful, often fall short in addressing sudden market changes or non-linear demand patterns, whereas AI-based forecasting offers more adaptive and accurate solutions by incorporating real-time data and external variables.

Evidence from practice shows that machine learning and simulation-driven approaches improve inventory planning, reduce stockouts, and balance service with cost efficiency across regions. Ultimately, aligning transportation planning with well-defined performance goals and continuously adjusting strategies in response to feedback enhances the resilience and sustainability of pharma supply chains.

We Find the Way

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Setting a Future-Proof Sustainability Strategy

Linus Wollentz, Envirotainer

Sustainability in pharmaceutical supply chains is positioned as a system-wide necessity to protect patients, ensure product integrity, and reduce emissions.

Six macro trends are shaping design choices: the rise of AI in decision-making, post-pandemic resilience priorities, consolidation through partnerships, expanded sustainability scrutiny beyond shipment-level CO_2, near-shoring of production, and the rise of personalised medicines that increase small-batch last-mile complexity. Companies are urged to align sustainability priorities across elements: planet, innovation, and people, using globally recognised frameworks such as the UN SDGs and science-based targets, rather than fragmented in-house schemes.

A future-proof sustainability strategy translates into three operational domains: safeguarding product integrity through packaging calibrated to lane conditions; boosting resource efficiency via leaner, lighter, and circular packaging solutions, balanced against geographic feasibility; and strengthening network resilience by pre-planning reroutes and reducing empty returns.

In air transport, the main levers are volumetric efficiency, weight reduction, reuse cycles, and maintaining uncompromised temperature control. Ultimately, sustainability is framed not as a one-off initiative but as a guiding operating principle: integrity is non-negotiable, efficiency delivers disproportionate impact, and resilient networks enable future-proof, science-aligned operations.

Key Takeaways ↗

Anchor to recognised frameworks:

Tie purpose to measurable goals using UN SDGs and Science-Based Targets to ensure credibility and comparability.

Design out loss:

Prevent product excursions through lane-appropriate packaging; avoiding write-offs prevents both patient harm and avoidable CO_2 from remanufacture.

Prioritise efficiency levers:

Reduce tare weight; maximise cube-out; extend reuse cycles; choose leasing to improve utilisation.

Be circular, not dogmatic:

Prefer reusables where return flows exist; retain single-use options to serve remote or low-return lanes.

Plan for rerouting:

Build multi-path networks and minimise empty repositioning; target one-way moves with payload.

Institutionalise sustainability:

Treat it as a continuous, company-wide discipline rather than a time-bound initiative.

Report transparently:

Track Scopes 1–3 and disclose progress; note airline methodologies that include container/pallet mass in emissions accounting.

02.
DAILY HIGHLIGHTS AND TAKEAWAYS

DAY 02

Day Chairs:

Ruud van der Geer, MSD
Frank Van Gelder, Pharma.Aero

Key Topics

- **Technology Drivers in a Sustainable Life Sciences Logistics Ecosystem**
- **The Value Chain Strategy**

Learning Objectives ↗

- Predict how emerging innovation methods in vaccine development could fundamentally transform the supply chain and logistics ecosystem
- Analyze Smart Manufacturing 4.0 in the life sciences and its impact on the evolution of the Value Chain 4.0
- Evaluate the impact of digital technologies on the end-to-end healthcare distribution model and the changing role of logistics
- Identify and assess key impact factors—such as economic imbalances and geopolitical tensions—that influence business strategy
- Develop and execute a strategic plan in a real-time business case scenario, collaborating with C-level executives

The Future of Vaccine Development: Are Teleportation and 3D Happening?

Prof. Dr. Pierre Van Damme, University of Antwerp

Global immunisation enters a decade shaped by four structural pressures: rapid population ageing (especially in Europe), rising numbers of “zero-dose” children, persistent vaccine hesitancy and the amplification of unvalidated information through social media. These forces increase outbreak risk (e.g., measles), complicate adult access strategies, and make trust-building an operational, not merely communications, priority.

On the technology front, the pipeline continues to broaden: mRNA platforms, including self-amplifying RNA (saRNA), are extending beyond COVID-19 (with Japan approving the first saRNA vaccine), while legacy live-attenuated approaches are being genetically stabilised (e.g., novel OPV2) to improve safety and sustain eradication campaigns. Plant-based expression systems promise locally manufacturable, thermostable options at lower cost.

Administration is shifting towards intradermal delivery and mucosal routes; standardised intradermal devices enable dose-sparing and improved tolerability, robotic intradermal systems are being piloted for surge campaigns, and mucosal vaccines aim to reduce transmission as well as severe disease.

“Digital teleportation” of genomic data, exemplified by the rapid global sharing of SARS-CoV-2 sequences, compresses development timelines but raises cybersecurity and geopolitical questions. Three-dimensional technologies already support pre-clinical tissue models, microneedle prototyping, training, and rapid manufacturing. The next frontier prioritises conserved epitopes and durable immunity to curb transmission; however, impact ultimately depends on rebuilding confidence among both the public and healthcare professionals.

Key Takeaways ↗

Four headwinds:

Ageing populations, “zero-dose” gaps, hesitancy, & social-media amplification increase predictable outbreak risk and complicate adult programme design.

Digital acceleration with risks:

Genome “teleportation” speeds design globally but demands strong cybersecurity and governance.

Broader platforms:

mRNA/saRNA, genetically stabilised live-attenuated vaccines (e.g., nOPV2) & plant-based systems expand options across pathogens and contexts.

3D already at work:

Pre-clinical models, device design, training and manufacturing benefit from 3D methods.

Administration innovation:

Standardised intradermal devices (and robotic delivery) enable dose-sparing; **mucosal** vaccines target transmission blocking as well as disease severity.

Trust is pivotal:

Technology advances require parallel investment in confidence-building and information validation for both publics and providers.

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The Preferred European Pharma & Life Sciences Gateway

The Sustainable Supply Chain Strategy: Smart Manufacturing & Forecasting Technologies

Gergely Szorcsik, Zoetis

Pharmaceutical manufacturing has moved from manual, waste-heavy production to an Industry 4.0 stack that integrates automation, ERP connectivity, IoT telemetry and AI. Historically high batch losses (>20%) have fallen below 1% through GMP enforcement, robotics, in-process controls and simulation-led design, improving quality, safety and cost profiles.

Digital twins enable virtual validation and change control before execution, while sensor networks support real-time monitoring and predictive maintenance to avoid downtime and scrap. AI-assisted forecasting links market signals to finite-capacity schedules, dynamically pulling production forward around foreseeable shocks (e.g., canal or port disruption) and reducing reliance on carbon-intensive emergency air freight.

Paperless batch records and OT–ERP integration strengthen data integrity, traceability and release decisions. Progress remains uneven across global networks, so many organisations pursue hybrid modernisation, incrementally upgrading legacy plants while building new, fully digital sites, balancing regulatory constraints (site-specific registrations) with continuity of supply.

Sustainability benefits flow from right-sized cold-chain packaging, reduced overproduction and fewer emergency shipments, alongside auditable ESG data collection.

Key Takeaways ↗

Industry 4.0 impact:

Automation + IoT + AI compress losses to <1% and raise quality and safety.

Digital twins & telemetry:

Virtual validation and predictive alerts prevent deviations, scrap and unplanned stoppages.

Forecasting as a sustainability lever:

AI scheduling aligns output to demand and limits emergency air moves and write-offs.

Traceability & compliance:

Paperless batch records and OT–ERP links enable auditable, lane-level decisions.

Pragmatic modernisation:

Hybrid upgrades address uneven 2.0–3.0 maturity and registration hurdles while protecting supply.

Lower footprint by design:

Right-sized packaging, better planning and modal discipline reduce emissions and cost.

Use Case The Future Value Chain Technology: More than Temperature?

Mikkel Bøttcher, DSV
Kevin Lynch, QProducts

The use case reframed pharma air freight sustainability as a process challenge rather than a packaging contest. Instead of validating a single thermal solution, the team validated an end-to-end temperature-control process across tightly controlled lanes (origin facility → airport handling → aircraft → destination), with strict limits on tarmac exposure and defined roles for on-site staff.

By treating the process as the “unit of validation”, compliant performance could be achieved with thermal blankets for 2–8 °C product on selected routes, realising cost and CO_2 reductions while maintaining quality.

Early deployments show shipment-level savings (reported around a third versus comparable active solutions), larger payload utilisation, and fewer handling steps, benefits that resonate with C-suite targets because they pair emissions cuts with tangible cost avoidance.

Governance is pivotal: quality sign-off hinges on documenting procedures, lane risk, handling times, and exception response, not on swapping vendors’ validated containers. The approach intentionally starts where operational control exists (limited airports/lanes with in-house teams), scaling only when process fidelity can be guaranteed.

Design specifics include a dual-layer blanket and six-sided PMC cover (lower and main deck), combined with IoT telemetry to detect misplacements and trigger interventions; real-world incidents illustrated how process discipline plus monitoring can avert excursions.

Circularity is addressed pragmatically: focus on high-volume, round-trip corridors to enable reuse and avoid reverse-logistics penalties; where imbalances exist, a process-validated approach lets different pharma shippers share flows without being locked to a single packaging SKU. Limitations remain (not universally deployable, airport variability), but the evidence indicates that “more than temperature” means orchestrating process control, data visibility, lane design and stakeholder alignment to deliver both sustainability and resilience.

Use Case: The Future Value Chain Technology

Key Takeaways ↗

Validate the process, not the box:

End-to-end SOPs, handling-time caps and lane risk controls enable compliant use of blankets on selected 2–8 °C routes.

Sustainability + savings:

Reported ~one-third shipment cost reductions versus comparable active moves, with higher payload utilisation and less handling—making the business case compelling.

Start where control exists:

Limit to airports/lanes with owned teams to guarantee execution; expand only when process fidelity is demonstrable.

Design + telemetry:

Dual-layer/six-sided covers plus IoT alerts support rapid correction (e.g., mis-zoned storage), reducing excursion risk.

Quality governance:

Pharma QA buy-in depends on documented procedures and evidence from test runs and lane pilots, not vendor claims.

Pragmatic circularity:

Target high-volume round-trips; a process-validated model lets multiple shippers share lanes and avoid reverse-logistics waste.

Known limits:

Not yet global; airport variability and extended handling times can erase the advantage—process discipline is non-negotiable.

An Environmental and Social Assessment of the Last-Mile Cold Chain Vaccines Distribution

Rafael Arevalo-Ascanio, University of Antwerp

The analysis compares active (vehicle-powered) versus passive (e.g., dry-ice) cooling for vaccine distribution in the last mile, adding a social impact lens via external cost accounting. Using a Flemish case (275 vaccination sites; paediatric demand proxy of 2–3 doses per child), the study separates line-haul (RDC → district) from the stop-dense last mile (within districts) to attribute emissions realistically.

Results show that active cooling's emissions scale sharply with stop frequency, door openings drive thermal load and fuel burn, whereas passive cooling's use-phase emissions are near-zero, with impacts concentrated in upstream production (e.g., dry-ice energy).

Sensitivity analysis indicates a context-dependent optimum: at lower stop counts, active units can remain competitive; as stops increase, passive solutions overtake on footprint.

Externalities (congestion, noise, accidents, well-to-tank, air pollution, climate) translate to ~€0.13–0.14 per vaccine box, underscoring that last-mile design choices have quantifiable social costs. Scenario testing suggests cargo bikes + passive cooling in dense urban clusters can deliver ≥10% emissions reductions. Strategic implications: reduce line-haul distance via more localised RDCs, right-size cooling to route characteristics, and embed equity and safety aims by incorporating external costs into operational decisions.

Key Takeaways ↗

Route intensity matters:

Emissions hinge on stop frequency: active cooling deteriorates with frequent door openings; passive is stop-agnostic in use.

Separate the legs:

Line-haul is a major emissions driver; shortening RDC → district distance materially lowers total impact.

Social costs are real:

Externalities add ~€0.13–0.14 per box; including them sharpens decisions on mode, route, and cooling choice.

Context, not dogma:

At low stop counts, active units can be preferable; beyond a threshold, passive solutions dominate on footprint.

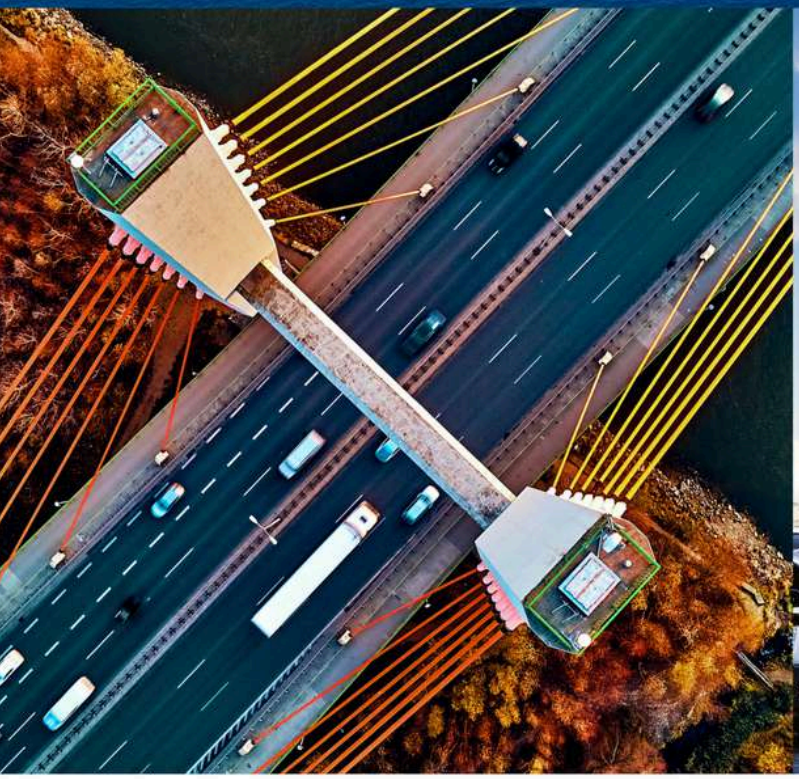
Urban lever:

In dense areas, cargo bikes + passive cooling can cut last-mile emissions by ≥10%.

Design for resilience & equity:

Right-sized packaging, demand-aligned routing, and multimodal options strengthen reliability while reducing emissions.

Control is the New Cold



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The Tech Impact Debate
Do All Supply Chain Roads Lead to AI and Digital Twins?

Roel Gevaers, Gergely Szorcsik, Maurizio Cecconi, Jean Metz & Frank Van Gelder

The debate characterised contemporary AI as powerful but immature: excellent at rhetoric and automation, weaker at causal reasoning and generating validated new knowledge.

Large language models (LLMs) produce plausible text and are valuable for drafting, triaging and summarising, yet remain prone to confident error; responsible use therefore requires verification and human accountability. Participants underscored a widening critical-thinking gap in education and hiring as some users treat LLMs as search oracles; curricula should pair manual reasoning with AI-assisted workflows and require oral defence to evidence understanding.

In healthcare and supply chains, immediate value lies in low-value task automation (e.g., AI scribes, email and scheduling agents) to free expert time, while high-stakes decisions must retain expert oversight and robust data governance.

Progress depends less on algorithms than on data infrastructure, usable, high-quality, governed datasets, and on methods that combine observational signals with trials to infer cause–effect.

AI agents are already practical in coding and operations; however, bias amplification and accountability remain live concerns.

The panel's bottom line: embrace AI for productivity and situational awareness, but pair it with guardrails, verification, governance, literacy, and clear ownership of data.

The Tech Impact Debate

Key Takeaways ↗

Rhetoric ≠ reasoning:

LLMs accelerate drafting and dialogue but can be wrong with confidence; verification and human accountability are essential.

Data before models:

Usable, governed datasets are the principal bottleneck to meaningful, real-time AI in healthcare and supply chains.

Automate the admin:

Immediate gains come from AI scribes, scheduling and coding assistants, freeing expert time for higher-value judgement.

Education & hiring:

Require critical-thinking evidence (e.g., oral defence); train users to compare AI outputs with manual analyses.

Agents are here, use judiciously:

AI agents can boost throughput; deploy with guardrails for bias, privacy and auditability.

Causality matters:

Combine observational data with trial-grade methods; do not let convenience replace hypothesis-driven testing.

Governance & ownership:

Clarify who owns data, who is accountable for AI-assisted decisions, and how outputs are validated.

The Tech Impact Debate
Digital Strategy in Motion: How Do You Stay Ahead of the Curve?

Arun Luykx, Brussels Airport

Digitalisation is the strategic use of technology to stay relevant by continuously creating value for customers and stakeholders. The focus was less on novelty and more on disciplined execution: selecting problems where technology, whether software, robotics, or data platforms, can clearly improve revenue, costs, customer experience, or risk, and then measuring results.

A four-stage maturity path was outlined: organise (clarify role and data foundations), digitise (convert analogue processes, run proofs-of-concept), predict (model flows and risks with integrated data), and prescribe/intelligent (use insights to trigger actions).

The Brussels Airport case illustrated this progression, starting with flight data, layering passenger and cargo flows, co-locating actors in an operations centre, and eventually pushing forecasts and recommended actions to smooth operations. The lesson: progress through incremental but rigorous steps that build trust and operational impact. Successful execution requires alignment across the organisation. A practical scheme suggested three elements: grounding ambition in core values and business model, setting guiding drivers that steer decisions (e.g., “reduce time-to-repeat”, “improve on-time performance”), and ensuring six execution functions, sales, communications, product development, support, operations, and finance/compliance, have clear ownership and KPIs.

Progress is rarely linear, so agility, evidence-based decisions, and willingness to reset are essential. Finally, collaboration beyond the firm, such as with other airports or customs authorities, can extend impact, but turning internal solutions into products demands careful attention to market fit and data governance.

Key Takeaways ↗

Value first, tech second:

Define digitalisation as value creation; measure revenue, cost, experience, and risk outcomes, not pilots for their own sake.

Climb the maturity ladder:

Organise → digitise → predict → prescribe; publish insights to stakeholders and wire actions back into operations.

Own the operating model:

Assign KPIs and accountability across “sell/tell/build/support/operate/finance” to turn strategy into behaviour.

Be evidence-led and agile:

Expect iterations and restarts; let data, not hype, decide when to scale or stop.

Ecosystem advantage:

Cross-airport collaboration and shared platforms raise transparency and reduce friction but require guardrails for data ownership and compliance.

02.
DAILY HIGHLIGHTS AND TAKEAWAYS

DAY 03

Day Chairs:

Prof. Dr. Shinya Hanaoka, Institute of Science Tokyo
Prof. Dr. Wouter Dewulf, University of Antwerp

Key Topics

- **The Japanese Global Life Sciences Industry**
- **The Japanese Supply Chain and Logistics Industry**

Learning Objectives ↗

- Evaluate the Japanese life sciences market within the context of global industry trends and dynamics
- Analyze Japan’s role in pharmaceutical innovation, particularly in the development of cutting-edge drug therapies
- Understand the structure and dynamics of the Japanese distribution model, and assess its potential as a benchmark for international application.
- Effectively present a strategic business case solution to your company's executive board, demonstrating analytical and communication skills.

From Precision to Progress: Japan's Vision for the Future of Life Sciences

Prof. Dr. Kamide Kei, Osaka University

Japan is the world's test bed for healthy longevity, with life expectancy among the highest globally and a rapidly ageing population (older-adult share ≈30% today and rising).

The demographic shift is faster than historical European ageing, compressing the time available to adapt health, social-care and labour systems. The immediate inflection point is 2025, when the baby-boomer cohort moves 75+, tightening support ratios and intensifying demand for chronic-care management and prevention. The strategic aim is to extend healthy life expectancy (narrow the gap between life expectancy and healthy-life years) through prevention, primary care, and community-based integrated support rather than hospital-centric models.

The science and innovation pillar emphasises dual tracks: (1) prevention and vaccination to contain infectious disease and reduce downstream system load; and (2) advanced therapeutics and regenerative medicine (e.g., iPS-cell–based interventions; novel disease-modifying agents) to address neurodegeneration, cardiovascular disease and cancer.

Osaka University's "co-creation" model operationalises academia–industry collaboration at scale (joint research chairs, venture support, translational platforms) to accelerate clinical adoption and industrialisation of life-sciences innovations.

Key Takeaways ↗

Super-ageing at speed:

Japan's shift to a ≥30% 65+ population, accelerating through and beyond 2025, demands prevention-led, community-integrated care models.

Healthy-life-years first:

Close the ~10-year gap between life expectancy and healthy life expectancy via screening, vaccination, primary care, and social participation.

Translational engine:

Academia–industry "co-creation" (joint chairs, venture support) speeds adoption of iPS-based therapies, novel drugs and med-tech into practice.

System design, not silo fixes:

Hospital consolidation, regional integration and digital foundations shift capacity to prevention and primary care, easing acute-care load.

National competitiveness:

Healthy longevity doubles as economic strategy, sustaining participation, lowering long-run costs & anchoring a globally relevant life-sciences ecosystem.

City Logistics Using Emerging Technologies

Prof. Dr. Eiichi Taniguchi, Kyoto University

City logistics aims to optimise private-sector freight activity in urban areas while balancing three goals: mobility, sustainability, and liveability. The approach integrates cyber–physical systems, digital twins, data platforms, and (conceptually) the physical internet, with operations on real road networks to cut cost, congestion, and emissions without eroding community safety and public health.

Delivery growth from e-commerce, climate targets, and disaster resilience pressures make this integration urgent. Collaboration across public authorities, carriers, shippers, residents, and researchers is essential; data-driven methods (big-data feeds from IoT sensors, behaviourally grounded models) support policy testing and operational design.

Data sharing is the pivotal enabler yet faces legal, competitive, and institutional barriers. Practical models exist: Rotterdam's city–industry–university scheme formalises bilateral data exchange under contract; Japan's nationwide ETC2.0 programme captures second-by-second vehicle movements (covering >90% of freight vehicles) and distributes standardised datasets for planning and operations across all road types. Standard formats lower transaction costs and make cross-firm collaboration feasible.

Emerging last-mile options, autonomous delivery robots (ADRs) and drones, offer contactless, time-flexible, lower-emission service but remain constrained by range (~5 km), speed, battery logistics and high initial/operational costs; mothership (van+robot) hybrids can be competitive as costs fall.

Japan has eased regulation (2022 legal changes; 2023 activation) to allow sidewalk operation with specified size/speed limits, accelerating trials. Drones provide speed for emergencies and disaster relief. For pharma, uncertainty and strict quality requirements argue for stochastic modelling, reliable real-time data, and IoT-equipped packages (temperature/security sensors) to enable adaptive routing, exception management, and resilient cold-chain service in dense cities.

Key Takeaways ↗

Tri-objective design:

Urban freight must deliver mobility, sustainability, and liveability, not just cost reduction.

Data is the fuel:

Contracted public–private data platforms (e.g., Rotterdam) and nationwide telemetry (Japan ETC2.0; >90% freight coverage; standard formats) unlock planning and real-time control.

Autonomy with guardrails:

ADRs/drones cut emissions and enable off-peak service; viability hinges on cost, battery/swap infrastructure, and clear regulation (Japan's 2022–23 framework).

Pharma fit:

Combine IoT telemetry, dynamic data, and stochastic control to maintain cold-chain integrity and service reliability in complex urban settings.

Patient Centric Pharma E-Commerce at Scale

Syed Haris Raza, Dnata

Pharma can borrow, and adapt, the e-commerce “playbook” to serve patients directly while safeguarding quality and compliance. At airport-centric hubs, a layered AI + IoT stack orchestrates bookings, DG auto-checks, automated weighing/imaging (including 3D), drone-assisted inventory verification, micro-temperature monitoring, and a 24/7 command-and-control room for lane risk profiling and exception handling.

The same architecture supports end-to-end API platforms across manufacturers, ground handlers, airlines and last-mile partners to deliver near-real-time visibility and dynamic capacity/routing. Customs was identified as the critical bottleneck; co-creating on-site inspection labs and segmented value streams (de minimis/e-commerce, ECCF, USDA) compressed clearance times from ~70–96 hours to sub-24 hours in a U.S. pilot, enabling faster, safer flows for perishables and temperature-controlled shipments.

Extending e-commerce disciplines to pharma means designing patient-centric fulfilment (personalisation, live tracking, agile reverse logistics) within a stringent compliance fabric (TSA/CBP/DSCSA/GxP), and building micro-fulfilment “nodes” near airports to reduce dwell and support Direct-to-Patient and clinical flows. Finally, tariff-driven shocks were shown to create hose-pinch, stop-start demand patterns; an ML forecasting suite improved fit over time and informed playbooks that pre-position capacity and inventory ahead of policy waves.

The through-line: platform integration, data governance, and customs co-innovation convert airport ground handling from a silo into a networked, patient-oriented service layer.

Key Takeaways ↗

Platform first:

End-to-end APIs + data lakes unify upstream/downstream actors for real-time visibility, dynamic routing, and quality control.

Command-and-control:

24/7 hubs fuse AI/IoT telemetry (temperature, location, handling) with analyst oversight to prevent excursions and speed decision-making.

Customs as keystone:

On-site labs and segmented flows can cut clearance from ~70–96 h to <24 h; regulatory co-design is as vital as tech.

Patient-centric last mile:

Live tracking and structured reverse logistics aim to deliver an “Amazon-grade” experience within HIPAA/DSCSA/GxP constraints.

Forecasting for turbulence:

ML models learn tariff-driven cycles and trigger proactive capacity/inventory moves rather than reactive firefighting.

Pragmatic rollout:

Start where infrastructure and partner readiness exist; avoid “tech for tech’s sake” and prioritise future-proof sensors/interfaces.


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Future Pandemic Preparedness: Transport and Vaccination

Prof. Dr. Shinya Hanaoka, Institute of Science Tokyo

Mobility restrictions during COVID-19, such as border closures, lockdowns, and digital contact-tracing, had far-reaching consequences for aviation, public health, and economic activity.

Passenger numbers collapsed in early 2020, with international recovery delayed in Asia until mid-2023. Policymakers faced the challenge of weighing infection risks against social and economic costs, and one proposed compromise was the “travel bubble”: bilateral or regional agreements without quarantine that sought to maintain economic links while containing risk. Examples like the Baltic states, Trans-Tasman, or Hong Kong–Singapore generated immediate boosts in travel demand but proved short-lived, complex to coordinate, and fragmented for travellers outside the arrangements.

To guide decisions on reopening, an epidemic–transport model linked population compartments (susceptible, vaccinated, latent, infectious, removed) with air-travel networks, revealing that dynamic, regularly re-optimised border policies delivered higher net benefits than static approaches, often worth hundreds of millions of dollars annually.

Complementary analysis of vaccine-sharing mechanisms across ASEAN+6 showed that coordinated, blockchain-enabled distribution accelerated international traffic recovery by weeks, cut societal costs by up to 80%, and balanced epidemic peaks between donor and recipient states.

Overall, adaptive border controls combined with collaborative vaccination strategies emerged as the most effective way to reduce both health and economic harms while ensuring faster, more stable recovery.

Key Takeaways ↗

Travel bubbles are a viable bridge:

Between lockdown and full reopening but are complex to sustain and often short-lived; design for rapid activation and clear exit criteria.

Dynamic control outperforms static rules:

Re-optimising border status monthly yields higher net benefits and better infection–economy trade-offs.

Model before you move:

Meta-population epidemic–transport models quantify country-pair-specific reopening thresholds and expected returns.

Share vaccines to speed recovery:

Coordinated cross-border allocation restores traffic earlier (≈7–8 weeks to 2019 levels) and cuts total costs by ~60–80% in many cases.

Governance is pivotal:

Align regulatory frameworks (vaccine acceptance, data, emergency powers) to operationalise adaptive openings without eroding trust.

Excellence in Logistics: From Pre-R&D to Finished Product

Camillo Rossi, Eli Lilly
Ruud Van der Geer, MSD
Freek De Witte, Air Cargo Belgium

End-to-end pharma logistics remains fragmented: commercial networks involve multiple handovers, outsourced 3PLs and heterogeneous market set-ups, with manufacturer visibility often stopping at the local DC rather than the pharmacy, patient, or administration point.

Next-gen therapies and compressed launch timelines are pushing a shift toward direct-to-patient models and finer-grained control. The operational baseline is still pallet-centred, high-volume flows, but future readiness hinges on (i) a digital logistics programme delivering node-to-node visibility, real-time alerts, intervention capability and ETA transparency; (ii) data capture below pallet level via unit serialisation portals (linking units to their environment) and device logging; and (iii) governance that reconciles standardised shop-floor execution with product- and patient-specific segmentation.

Clinical-trial logistics provides a template: a control-tower approach with actionable data (not dashboards for their own sake), broker integration, and clear role splits with CROs improves cycle time and quality while preserving compliance.Reported benefits included meaningful FTE savings, 30–40% cycle-time reductions, and fewer last-mile failures. Progress also depends on people, empowered teams with decision rights, and on vendors who understand clinical and commercial nuances (tailored service levels, hybrid last-mile) rather than “customise-everything” toolkits.

Finally, commercial shippers are increasingly involved pre-licence (before full stability data) to protect launch windows, raising the bar for quality, data sharing and risk management across the ecosystem.

Excellence in Logistics: From Pre-R&D to Finished Product

Key Takeaways ↗

Visibility beyond the DC:

Build node-to-node telemetry today; extend down to unit level with serialisation portals and selective device logging.

Actionable control towers:

Instrument only what you can act upon; couple alerts with clear intervention playbooks and release decisions.

Standardised vs Segmented:

Protect shop-floor standard work while enabling product/patient-specific pathways for advanced therapies.

Clinical as a proving ground:

Broker integration, right role splits with CROs, and milestone-driven visibility cut cycle time and rework.

People first:

Empower logistics teams with decision rights; treat dashboards as tools, not outcomes.

Vendor fit matters:

Prefer partners who grasp clinical/commercial specifics (hybrid last mile, lane SOPs, tailored SLAs) over generic “customise-everything” offers.

Pre-licence readiness:

Expect earlier commercial involvement; design QA/data governance to support pre-approval flows without compromising compliance.

Innovating Pharmaceutical Air Transportation for Japan's Unique Society and Geography

Dai Yuasa, ANA Cargo

ANA Group has positioned itself as Japan's leading pharmaceutical carrier, leveraging its extensive passenger and freighter network to ensure reliable global coverage. During the COVID-19 pandemic, it played a pivotal role in transporting millions of vaccine doses to Japan and neighbouring Asian countries, adapting regulations and processes to maintain safe and timely delivery. The group also commits to sustainability, targeting net-zero CO_2 emissions by 2050, while maintaining certified pharmaceutical standards across its operations.

Key challenges include meeting strict timeframes for sensitive cargo such as CAR-T cell therapies, addressing demographic and environmental shifts in Japanese society, and ensuring medical access to underserved regions. Solutions have been developed through a carry-on baggage model for ultra-fast pharmaceutical transport, automation and eco-friendly designs in Narita's state-of-the-art pharmaceutical warehouse, and drone-based delivery to remote islands to improve accessibility. These initiatives demonstrate a strategy built on operational excellence, technological innovation, and sustainability to strengthen pharmaceutical logistics and support society's evolving needs.

Building a Pharma-Ready Gateway for Japan and Asia

Fabian Gourdon, Kansai Airports

Kansai International (KIX) anchors a three-airport system (with Itami and Kobe) positioned to serve Japan's second-largest economic region.

Built on an offshore artificial island, KIX operates 24/7 with no curfew, giving consistent slot availability and runway access. While passenger traffic collapsed during COVID-19, air cargo remained stable and even set records, reinforcing cargo's role in the airport's resilience.

Strategic bets centre on pharma: KIX obtained IATA CEIV Pharma as Japan's first COE airport (2019), convened a cargo community to align handlers, airlines and shippers, and invested in near-runway temperature-controlled warehousing (plus partner facilities on and off island). The import mix shows pharma as the top value category, with Europe prominent on inbound lanes and China the largest partner on both import and export.

The airport positions air and ocean as complementary (speed/urgency vs. cost/efficiency), and links its pharma strategy to broader environmental commitments, ACA Level 4, SAF development from regional waste-oil feedstocks, and continued infrastructure expansion to support quality, reliability and differentiation versus larger hubs.

Healthcare Logistics Strategy and Network Build-Out

Samuel Speltdoorn, Nippon Express Group

Nippon Express Group (NX) outlined a healthcare growth strategy built on global scale (57 countries, ~78k employees) and end-to-end capability across air, ocean, warehousing (top-three globally), customs and value-added services.

Recent moves include specialised acquisitions (e.g., MRI “door-to-floor” installation via Simon Hegele; deep-frozen human-cell storage via BCM) and a Western Europe healthcare gateway in Brussels to consolidate flows into Japan/Asia.

Using a VUCA frame, NX links industry pressures, labour shortages, rising GDP/GMP expectations, sustainability, visibility gaps, geopolitics and cost inflation, to responses around vision, understanding, clarity and agility: warehouse automation and robotics; IoT real-time tracking; digital compliance; EV fleets and reusable packaging pilots; and “NX Brain” assistance for frontline tasks.

During COVID-19, NX chartered dedicated freighters (e.g., Belgium–Japan) to stabilise capacity for healthcare and PPE. In Japan (2021), NX stood up four GDP hubs (East Japan/Tokyo, West Japan/Osaka, Toyama, Fukuoka) with large ambient (15–25 °C) and 2–8 °C capacity to deconsolidate imports and serve domestic distribution; ambient remains the dominant warehousing segment. Quality remains the central tenet as NX scales its healthcare ecosystem and extends GDP standards across the network.

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02.

DAILY HIGHLIGHTS AND TAKEAWAYS

DAY 04

INDUSTRY VISITS AND WORLD EXPO OSAKA 2025

Kansai International Airport (KIX) Cargo Area & KIX Medica

Touring Japan's first airport-based temperature-controlled pharmaceutical warehouse.

Panasonic Kusatsu Shiga Base

Guided tour of Panasonic's product showroom

Nippon Express West-Japan Pharma Center

Discovering state-of-the-art pharmaceutical logistics: strict dual-zone temperature, and specialized pharma vehicles designed to safeguard critical products

Kobe Seaport

Cruise tour of the Kobe waterfront, including the container terminal, Kobe Bridge, and Kobe Airport

World Expo Osaka 2025 - Saving Lives

Masterclass Certificate Ceremony & Farewell Dinner at BelExpo – Belgium's Pavilion at World Expo Osaka

03. 2025 PLMC KEY TAKEAWAYS

Demand, geopolitics and resilience

Pharma is entering a decade of higher demand and more individualised care, enabled by AI-driven R&D and visible supply chains.

Resilience now means moving from JIT to JIC with multi-regional sourcing, pre-qualified alternatives, buffer stocks, and multi-node air-freight networks.

Tariffs are shaping both contracts and footprints, with pass-through and flexibility clauses becoming standard while sourcing and production are shifting step-by-step toward near/reshoring.

Patient, vaccines and trust

Vaccine pipelines are expanding (including mucosal candidates), and in super-aged societies, prevention and vaccination are central to healthy longevity.

Population protection depends on matching products to global immunisation needs and communicating through credible, validated information to sustain uptake.

Digital, data and AI

High-quality, well-governed data are the backbone of digitalisation, powering end-to-end control towers, real-time visibility, and excursion prevention under GxP/PHI rules.

Early AI value stems from automating routine work. However, real gains require redesigning roles and decision-making processes while managing risks associated with data quality, sovereignty, GDPR compliance, and supplier/provider lock-in.

Sustainability and network design

Sustainability starts with smarter manufacturing and demand forecasting, while network design reduces CO_2 by localising DCs and optimising line-haul.

Cooling choices should follow the route profile, with passive systems sometimes outperforming active on multi-stop last-mile routes based on CO_2 and external-cost analysis.

Execution and partners (E-pharma, 3PL/4PL)

Patient-centric distribution applies the e-commerce playbook: connect partners via APIs, keep GxP stocks near demand, track in real time, route dynamically, ensure first-attempt delivery, protect PHI, and enable easy returns with agile 3PL/4PL support.

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