Healthcare White Paper

How circular economy principles can
improve supply chain resilience and competitiveness?

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Executive Summary

DSV are a global transport and Logistics organisation operating healthcare solutions across the globe. Operating in 80 countries with approximately 75,000 employees and a turnover of $33.37 Billion. DSV was the first global logistics and transport organisation to make a science-based target declaration demonstrating that we are committed to sustainability and working on nature's terms.

A Gartner study revealed that 70% of supply chain leaders are planning to invest in developing Circular Economy practices within their supply chain. However, only 12 % have combined their digital and circular processes (Gartner, 2020). This speaks to a lack of knowledge, experience, and tools for organisations beginning their supply chain transformation journey.

The biologics, pharma, and health industries must now take urgent action to address their consumption of single-use plastics and implement an end-to-end strategy for environmental protection. Despite the industry's challenges, particularly in the biologics and health sectors, this white paper describes how the use of a maturity tool can help organisations move faster toward achieving sustainability goals and safeguarding patient safety.

The supply chain model for most remains linear which describes how finite resources are extracted, manufactured, consumed and disposed of leading to the depletion of original resources and wider negative impacts on society and the environment. A circular supply chain comprises a series of supply chain processes that improve the lifespan of products and enable core restorative and regenerative processes to be implemented (Lovins and Braungart 2014; World Economic Forum 2014).

The Circular Economy model, presented as an alternative to the traditional linear supply chain, promotes coordinated forward and reverse flows, extending product lifespan and restorative processes. Opportunities for supply chain transformation, ranging from awareness and exploration to continuous improvement, are outlined to guide companies in adapting to the dynamic market.

Strategies for moving at pace recommend using a maturity assessment to identify areas for improvement, enhance transparency, and communicate sustainable commitments.

Embracing circular economy principles can strengthen supply chain resilience and competitiveness, positioning pharmaceutical businesses as leaders in the evolving global landscape.

To assist organisations on their circular journey, DSV offers a free maturity assessment tool, providing a practical flight path for all stages of the circular supply chain.

Introduction

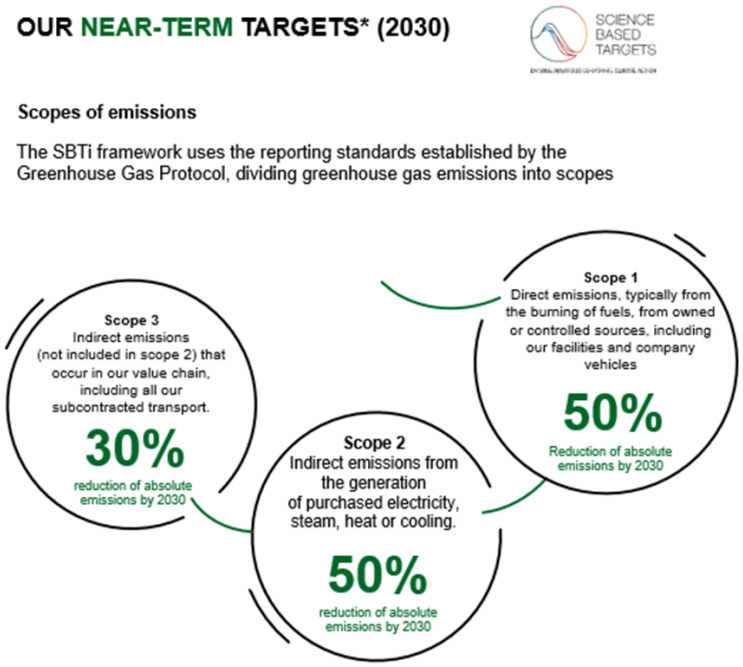
Sector research has highlighted key factors that promote the circularity of supply chain across healthcare, progress in "bending the supply chain" in this sector has been minimal. Alignment with current legislation as well as analysis from focus group discussions have highlighted that there are multiple barriers to circularity, including legislation, lack of information or interaction between stakeholders, and rigid practices that hinder progress. To successfully develop circularity, it's necessary to understand the causal links along the value chain.

DSV's rich history of agility and transformation perfectly equips us to lean into the demands and challenges of the climate crisis across this sector. This white paper will highlight our expertise in managing sustainability and our commitment to remaining a global sustainability leader. We are well on the way to "bending our own supply chain" to maximise Circular Economy opportunities; knowing that this creates resilience and enables us to deliver and often exceed our targets.

We are thrilled to be able to share with you a proven tool that triangulates both academic based research, experienced based leadership, and real-world customer experience, resulting in a proprietary circular economy maturity assessment tool. Alongside this tool, this paper will provide insights into the flight path towards achieving an improved circular supply chain.

Meeting the Moment: Bringing Science-Based Targets to Global Pharma

DSV can boast that we were the first 3PL to market making a declaration of our key evidence-based climate targets which currently include:



Our sustainability journey started early, and we have made significant inroads. We now share our evidence-based views through our own experiences and those we have shared with our global customer base. In addition, we draw from wider expertise like Gartner, whose 2020 survey cited 1374 supply chain leaders revealing that 70% are planning to invest in developing Circular Economy practices within their supply chain. Still, only 12 per cent have combined their digital and circular processes (Gartner, 2020). This speaks to a lack of knowledge, experience, and tools for organisations beginning their supply chain transformation journey.

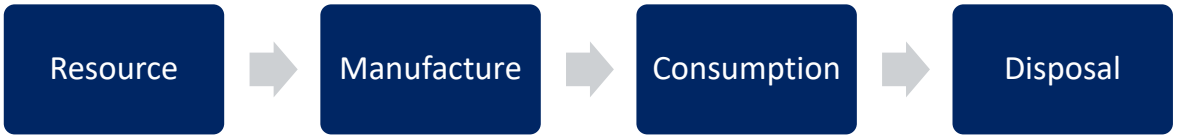
Environmental, social, and corporate governance is high on the agenda for most industries today, however, the biologics, pharma and health industries have a complicated relationship with environmental sustainability, given their need for low bioburden or sterile manufacturing, which currently favours the use of single-use consumables. Yet pharma and others in the health sector need to address their consumption of single-use plastics, broadening the focus from solely patient safety to include environmental protection, with a consistent end-to-end strategy that leaves no room for accusations of greenwashing. Although **patient safety will always be paramount**, the industry must strike a balance, so that measures that keep patients safe do not contaminate entire communities.

Therefore, this sector must expedite its transition to a Circular Economy (CE) cycle. This is predicated on business models facilitating reverse cycles, cascading of products, by-products, and waste outputs, and requires a willingness to explore circular supply chain form(s) and their embedded circularities. This white paper will describe the role CE practices can play and the roadmap to bending the traditional linear model, assessing readiness and maturity levels in the supply chain, and enabling organisations to invest in circular principles. Finally, it will describe a proprietary tool DSV offers to help organisations launch their critical journeys.

Clear levels of maturity allow organisations to evaluate their stage of implementation and strategically plan their development. Modelling enables organisations to sequence opportunities aligned with their capabilities, which in turn will improve their chances of success.

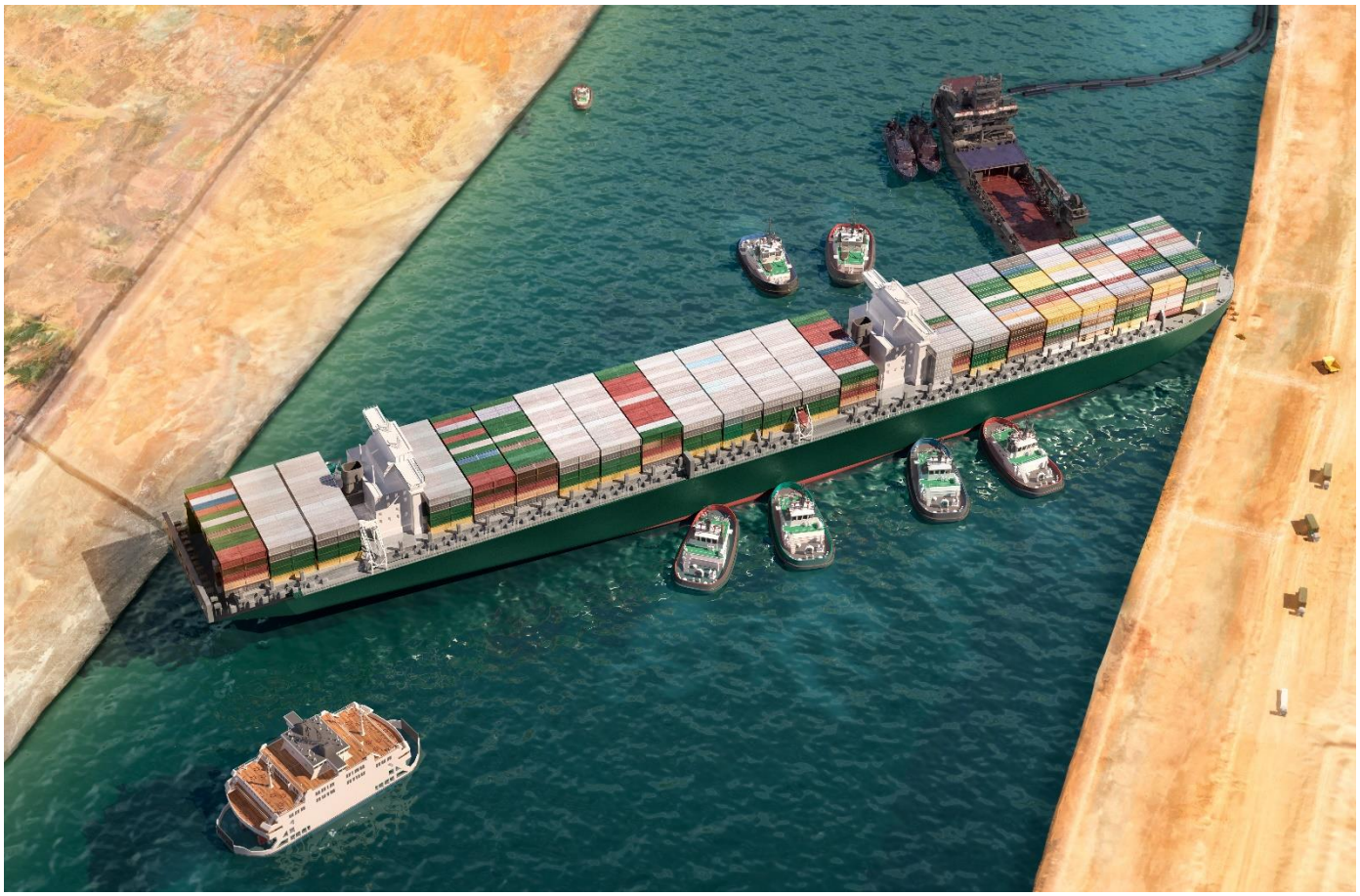
Traditional Supply Chain Models

Linear supply chain model resources are extracted, manufactured into products, used by consumers, and then disposed of—with each step requiring transportation of materials.



The fundamental failings in the linear model can be similarly followed along a one-way arrow. Manufacturing cannot function without a constant input of materials, and issues occur if a resource's availability diminishes. Resources extracted are often finite and suffer from depletion with no means of replacement; this scarcity affects availability and pricing. Disposal removes any potential resources from the system completely. As transportation is required at each stage of the model, linear supply chains can be broken at multiple points within the process with no method of mitigation.

Case Study



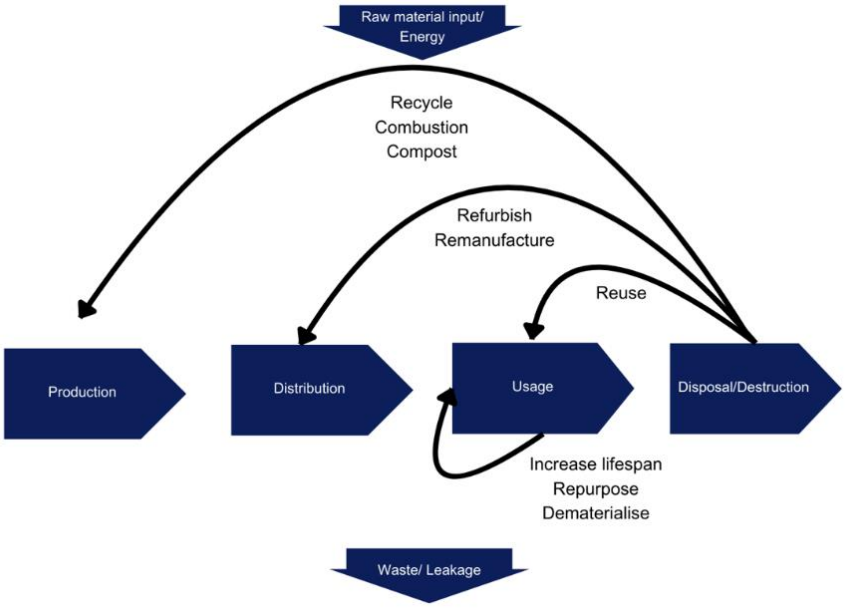
The fragility of the linear model was evident in the aftermath of the Suez Canal blockage. In 2021 the 400-metre, 220,000-tonne container ship Ever Given became lodged in the Suez Canal for nearly a week, disrupting trade on a global scale. The shutdown of transport caused resource prices to increase, manufacturing delays, and a subsequent price increase for everyone in the supply chain and the end purchaser.

Circular supply chain is a collective term for the coordinated forward and reverse supply chains. More specifically, a circular supply chain comprises a series of supply chain processes that improve the lifespan of products and enable core restorative and regenerative processes to be implemented (Lovins and Braungart 2014; World Economic Forum 2014). These forward and reverse flows can be undertaken through traditional and restorative/regenerative supply chains.

The circular economy is based on three tenets that support **supply chain resilience:**

- Remove waste, complexity and toxicity from products for more effective end-of-life resource management.
- Keep raw materials in use for as long as possible and at their highest quality.
- Return materials into the environment with a positive impact.

Key principles include designing for longevity, minimising waste, and maximising the value of materials throughout their life cycle. Overall, the circularity of the model can be an end-to-end application, as seen in post-consumer recyclables. The scope of the circularity can also be smaller, providing a feedback loop within the supply chain to maximize the use of resources.



Geissdoerfer, M., Pieroni, M.P., Pigosso, D.C. and Soufani, K., 2020. Circular business models: A review. Journal of Cleaner Production, 277, p.123741.

Benefits of a Circular Model

At the production stage, an increase in the cost of raw materials or even a lack of resources will no longer prevent production, as input of materials is still provided via the recycling of the disposed product. Organisations can maximise this available input through product design with a focus on increased disassembly, material recyclability, and reuse or refurbishment.

At the distribution stage, a collapse of input from production is mitigated by the input from disposal. Reuse and refurbishment can allow the distribution to continue.

Experience share

In 2012 DSV and Avanos created a repair and refurbishment centre of excellence in Ghent, Belgium. The partnership arose from initially a speed of service problem with one of it's medical devices and broadened to encompass more holistic goals of sustainability. Through partnership working an initial set of parameters for repairs was agreed. Repairs were completed to get essential medical devices back out into hospitals and clinical settings more quickly. The DSV technicians suggested improvements in the process such as harvesting assets from end-of-life machines to reuse against additional refurbishment categories.

Lessons learnt over the period have included procurement goals should contain both performance goals and exploration goals. In the early days, the contract promoted transactional performance goals such as turnaround time for repairs only. As the relationships matured DSV were able to creep the scope by suggesting better ways to achieve the output goals of efficiency and creating effectiveness goals. In addition, the measurements included how long products could be used without additional intervention post refurb or repair.

Intervention mapping with causal secondary repairs was anticipated, as by now machines were living beyond their original performance frontiers. So different repairs were arising from those originally commissioned. Testing and triage goals were explored, preventative triage was developed which had been out of scope. Reuse of harvested assets from end-of-life equipment extended the scope of services and created different opportunities for servicing.

Metrics across the service failed to keep up with the onset of sustainability goals, as the service was originally commissioned for other purposes. However, we can say that:

- 750 number of machines are repaired annually
- Rising numbers of parts are harvested and re-used
- Machine life has extended significantly
- Reduction in raw materials has increased
- Increasing number of days wear, of additional use of original parts
- Increasing number of products recycled

For the end user, issues with production and distribution have a lessened impact, as products are easier to repair, more durable, and designed for multiple uses thus machine availability is no longer a cause for patient treatment delay or cancellation.

Opportunities to Bend the Supply Chain

In the rapidly evolving global landscape of supply chain management, businesses are faced with myriad challenges and opportunities. To not only adapt but thrive in this dynamic environment, companies must embrace change and seek innovative solutions. There are multiple opportunities to transform the supply chain by leveraging various stages of development and improvement.

Awareness and Understanding

Initiating the transformation of the supply chain requires a solid foundation of awareness and understanding. Companies must remain aware of ever-changing market dynamics, emerging technologies, and evolving consumer expectations. By fostering a deep understanding of their supply chain ecosystem, organisations can pinpoint areas for improvement and innovation.

Exploration Unveils New Horizons

Exploration involves actively seeking novel solutions. Companies can delve into emerging technologies, alternative sourcing strategies, and innovative logistics models. This phase allows organisations to broaden their perspectives, uncover hidden efficiencies, and identify potential partners or technologies that can enhance their supply chain.

Building the Foundation for Success

A successful supply chain transformation necessitates a robust foundation. This includes investing in infrastructure, implementing efficient processes, and cultivating a culture of collaboration and adaptability. A strong foundation provides the necessary support for subsequent stages of development.

Integration Enhances Efficiency

Integration is the seamless connection of components within the supply chain. This involves integrating technology solutions, data analytics, and communication channels. A well-integrated supply chain enables real-time visibility, effective collaboration, and streamlined processes, ultimately enhancing overall efficiency.

Optimization Hones Processes

Once the foundation is established, the focus shifts to optimization. This stage involves fine-tuning processes, reducing waste, and maximizing resource utilization. Leveraging data analytics and artificial intelligence enables companies to identify optimisation opportunities, enhancing operational efficiency and reducing costs.

Innovation Drives Evolution

Innovation is the driving force behind supply chain evolution. Companies should cultivate a culture of continuous innovation, exploring cutting-edge technologies such as blockchain, IoT, and AI. Innovation leads to breakthroughs in supply chain visibility, traceability, and responsiveness, providing a competitive edge in the market.

Leadership Guides Transformation

Strong leadership is essential for guiding the supply chain through its transformation journey. Leaders must champion a culture of innovation, prioritise sustainability, and foster collaboration both internally and across the supply chain network. Leadership that understands the importance of agility and adaptability can navigate complexities effectively.

Striving for Excellence

Striving for excellence involves setting high standards and continuously improving performance. This includes benchmarking against industry best practices, monitoring key performance indicators, and regularly evaluating and refining processes. Supply chain excellence is an ongoing commitment to delivering value to customers and stakeholders.

Continuous Improvement

The journey to bend the supply chain is never truly complete. Continuous improvement is an ongoing commitment to monitoring, evaluating, and adapting to changing circumstances. Companies should embrace a mindset of continuous improvement, seeking feedback and proactively addressing challenges to stay ahead of the curve.

Bending the supply chain to meet the demands of the modern business landscape requires a strategic and holistic approach. By progressing through the stages of awareness, exploration, foundation, integration, optimization, innovation, leadership, excellence, and continuous improvement, companies can position themselves for success in an ever-evolving market.

Considerations for the Pharmaceutical Industry

Pharmaceutical packaging (PhP) is a group of products that have a complex purpose: to protect medicines and provide information. Packaging waste is generated at various stages in the value chain, and despite political pressure to reduce waste and increase material circulation, packaging has continued to grow in this sector. Research has highlighted key factors that promote the circularity of pharmaceutical packages, but progress in the sector has been minimal. Alignment with current legislation as well as analysis from focus group discussions have highlighted that there are multiple barriers to circularity, including legislation, lack of information or interaction between stakeholders, and rigid practices that hinder product design. To successfully develop circularity in packaging, it's necessary to understand the causal links along the value chain. Chemical recycling technologies are expected to help maintain clean cycles. However, further studies are needed to demonstrate the environmental benefits of increasing circularity along the value chain of pharmaceutical packaging. This transition requires a systemic change, yet existing literature and discussions on utilizing the circularity of the PhP are neither fulsome nor fast-paced.

Pharmaceutical packaging consists of various materials such as cardboard (boxes), paper (labels and leaflets), glass (e.g., ampoules, vials, and bottles), plastics (e.g., closures, bottles, blisters, bags, tubes and laminates with paper or foil), metals, and rubber (e.g., closures). PhP materials require safeguarding from external impacts such as humidity, oxygen, light exposure, temperature changes, and mechanical damage. Regulatory requirements—including labelling and product information—are also necessary for safe usage. Convenience of use is another essential attribute.

Pharmaceutical plastics can be difficult to recycle due to their complex requirements, and the technology needed for this recycling is still in its early stages. Healthcare plastics may need to be sorted before recycling due to risk of biohazard contamination, but cardboard, aluminium, and glass are best managed within their dedicated recycling streams. The challenge in promoting circularity is that it can lead to trade-offs between environmental impacts and the residues of harmful substances in packaging. However, there are possibilities for innovation; emerging trends in PhP development include counterfeit prevention, child-resistant packaging, and eco-friendly packaging. Although the choice of packaging material primarily depends on the nature of the pharmaceutical, opportunities for innovation include increasing the circularity of packaging by making smarter material choices and reducing packaging. This area is ripe for additional research and development. DSV has been working with the packaging

sector to champion its customers' needs and in 2023 hosted a number of summits bringing packaging companies and customers together. Facilitating listening sessions and allowing vendors to showcase sustainable options.

PhPs are typically divided into either primary, secondary or tertiary packaging, depending on their contact with the actual pharmaceutical product. Primary packaging materials are in contact with the pharmaceutical product, but secondary packaging may be needed, for example, to ensure proper labelling. Tertiary packing such as plastic wrappings around pallets may be added to facilitate the transportation of products between value chain operators. Notably, plastics represent one major material type in primary PhP. The commonly used plastic polymers in primary PhP include polyvinylchloride (PVC), polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), polycarbonate (PC), polyamide (PA), polystyrene (PS) and polyurethane (PU). Blisters and bottles are common because almost half of all pharmaceuticals are administered orally.

No one can see the future of PhP but the industry may see more pressure to resolve some of these seismic issues. Much like how the fashion industry has been 'encouraged' to move to more sustainable kinds of cotton, products now proudly display sustainable swing tags allowing users to identify sustainable production. For over-the-counter products, consumer demand may come to expect declarations of sustainable products so choices can be made. Additionally, we have already felt the impact that EU Procurement Law, governing how the public sector procures has already introduced sustainability as a category for special consideration. For larger buyers such as the NHS, they had begun to allocate up to 10% of the available procurement scores to sustainability. With the Autumn rollout of the replacement law the 'Procurement Act 2023' we expect to see the continue of this focus and we will inevitably see the NHS begin to ask for more evidence of supply chain sustainability.

While changes to primary packaging may take longer to develop and test, emerging vendors are developing sustainable solutions. One such UK-based vendor is Pluumo. They have been developing and testing new-to-market options that will provide more sustainable options to this sector.

Pluumo is the world's first thermal packaging solution powered by surplus feathers and outperforms expanded polystyrene (EPS) as an insulator. EPS is still commonly deployed in the cold chain but after disposal, it remains in our environment for centuries. There is an urgent need to move away from single-use plastic packaging and also to reduce carbon emissions. However, sustainable alternatives have traditionally sacrificed thermal performance. Life science industries in particular have been hesitant to compromise given the high-value products that must be kept cold during transport.

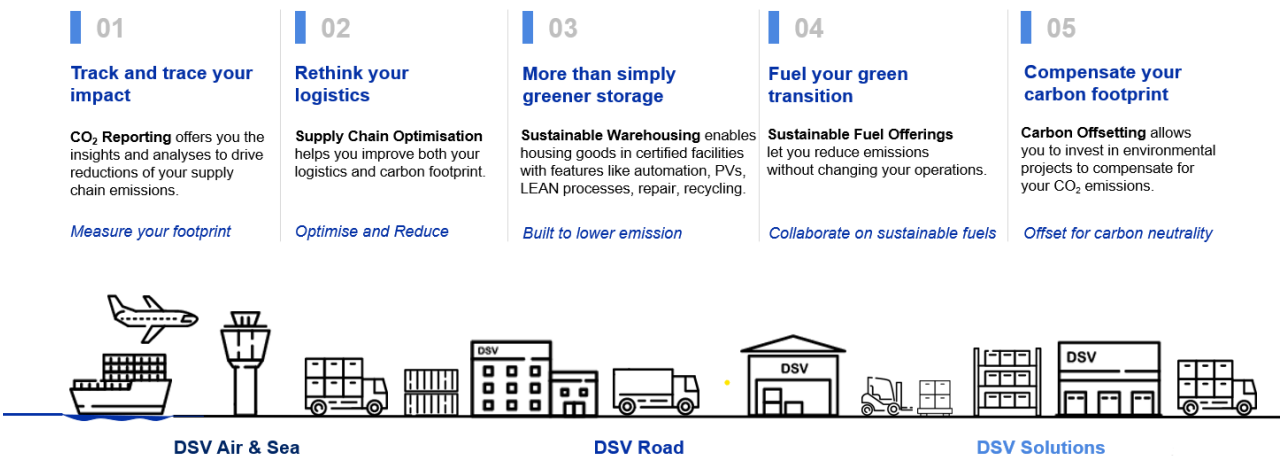
Harnessing natural properties, Pluumo outperforms EPS as an insulator by up to 25%. Simultaneously, it lowers the carbon impacts of materials and manufacturing by 75% and avoids plastic packaging in landfills.

Embracing the circular economy, Pluumo is currently created by intercepting landfill-bound surplus feathers that are not suitable for the bedding and clothing industries. Over 5 million tons of surplus feathers are produced globally, so Pluumo can be sourced and manufactured locally to enable a more resilient supply chain for critical packaging components. Post-use, Pluumo has been designed to be industrially composted and future development will explore home composting. Re-using Pluumo is also possible, further championing the potential of the circular economy.

Emerging products and services that help ‘bend the supply chain’

DSV as your expert partner means we have a line of sight on most emerging products and services which support our customers achieve an optimised blend of compliance, sustainability affordability and performance. Our reach spans packaging, transport, storage, technology automation and AI solutions. We are ready to connect our customers with better options which help ‘bend their supply chains’.

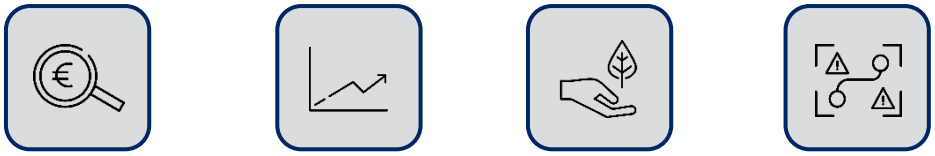
DSV has a Green Logistics service portfolio which provides a full suite of solutions that reduce your carbon footprint across your supply chain.



Track and Trace

Offering C02 reporting, providing insights and analysis to drive reductions across your supply chain emissions. Spanning cargo, road and rail. With our partner EcotransITworld we offer automated energy consumption and C02e calculations. EcoTransIT World’s calculation methodology has been developed and is maintained and validated by independent scientific institutes (Ifeu, INFRAS and Fraunhofer IML). EcoTransIT World is the first industry CO2 calculation tool to receive Global Logistics Emissions Council (GLEC) framework accreditation. Also meets the requirements of EN16258 and the GHG protocol.

Supply Chain Optimisation



Minimise costs | **Improve service levels** | **Minimise CO_2** | **Manage risk**

Enabling you to rethink your supply chain logistics, helping you improve both your logistics and carbon footprint. By reviewing costs, performance of services and risk we can deliver optimisation. Through implementing diagnostics with a thorough supply chain scan we collect and synthesise your data to triangulate into the design and optimisation phase. The initial phase will deliver a decarbonisation road map. This will consider sustainable fuels including sustainable air fuel, marine bio fuel and bio fuels and the consideration of carbon off setting. The design and optimisation phase has regard for optimisation opportunities within fill rates, transport, routing and network. Our optimisation services operate independently of our DSV operational delivery divisions and provide a hands-on approach. Combined this provides a compelling value realisation proposition that delivers across cost, performance, carbon reduction, compliance and risk.

Sustainable Warehousing

Perhaps the simplest consideration for Pharmaceutical companies is to simply select a sustainable warehousing solution. DSV has already delivered two new health sector BREEAM-rated Excellent sites in the UK and Ireland. Whilst the physical buildings are designed to a high specification it's not the only sustainable feature. Our practices within the warehouses support sustainable operations. Deploying our proprietary service excellence model which combines sustainable operations design, DSVSigma (the lean six sigma continuous improvement philosophy and practice), and automation. Within the warehouse significant 'bending of the supply chain' has already taken place such as:

- Introduction of paper tape to reduce packaging waste
- Minimisation of stretch foil for wrapping
- Reduction of labels and waste
- Repurposing of cardboard waste

Case Study

As an expert partner, we already adopted paper-based tape for sealing boxes as standard for all willing customers. This was an obvious strategy, as the tape performs as well as the plastic variant and has a better price point. For most customers, the decision to switch was simple.

In addition, we have also developed UK-based 'Remaker' service centres of excellence. These services facilitate the process of prolonging the lifetime of products or transforming waste through initiatives such as:

- repairs
- refurbishment
- remanufacturing
- recycling
- reselling

For example, within these centres, we can retrieve those articles and assets that can be reused such as outer cardboard packs and information leaflets. These can be harvested and turned into other products. This is particularly useful when product batches expire and are waiting for destruction. Sending solely product blister packs for destruction versus sending the product leaflet and outers equates to less weight. This means less C02 emissions from destruction. The paper and card elements can be sold for scrap or where practicable can be shipped back to the manufacturers for reuse for production or tertiary packaging.

In our follow up paper in October 2024 we will share more detail from some of DSVs customers around the world on the practical application of some of these tactics.

Fueling your green transition

Partnering with DSV on sustainable fuel offerings allows you to:

1. Reduce the C02 from transport without any changes to operations
2. Benefit from DSV's knowledge, expertise and seamless service to manage end-to-end process
3. Contribute to the development and adoption of sustainable bio-based fuels
4. Take responsibility for the green transition and trade on nature's terms

Compensate your carbon footprint

Gold Standard for the Global Goals

1. Compensate CO2 emissions that cannot be avoided
2. Benefit from our service to manage the end-to-end process, including all administrative processes
3. Contribute to the development and adoption of sustainable environmental projects
4. Be perceived as a responsible and green company

Strategies for Implementation

Fundamental to evolving into a circular model is assessing an organisation's starting point. Undertaking a maturity assessment presents several key benefits. It provides a comprehensive overview of current circular economy practices within the organisation and identifies strategic areas for drafting and implementing new policies.

Identifying inefficiencies and gaps in current data collection and monitoring and reporting are fundamental in calculating resource usage, waste, and overall sustainability performance. Insight generated from this process enables targeted interventions and defines a roadmap for transitioning to a circular business model. This further empowers the assessment of the circularity of the entire value chain, identifying vulnerabilities and opportunities for enhancing resilience in the face of supply chain disruptions.

Additionally, a maturity assessment brings forward transparency and accountability when communicating the company's commitment to sustainable practices to stakeholders, customers, and the wider community. In an era when significant scrutiny is applied to a business's intent and actions regarding sustainability, this assessment and subsequent developments can improve brand reputation and stakeholder trust.

"Understanding and assessing an internal operational structure is best done in tandem with the customer, as they have intimate knowledge of their processes and controls, whilst a third party can add value to their operations by offering granular perspective. DSV's maturity assessment tool is exactly that; it is set up to assist the customer in closely analysing their current 2030 pathway, adding clarity to their situation to allow them to make substantive decisions by being in possession of all the facts, thus allowing continual improvement and planning."

Adrian Reynolds, Insynch Energy Services

Summary and Next Steps

Embracing circular economy principles is a transformative strategy with the potential to significantly enhance the resilience and competitiveness of supply chains. By shifting from the traditional linear model to a circular framework, pharmaceutical businesses can bolster operations against disruptions, promote sustainability, and position themselves as leaders in a developing global landscape.

Getting started – Free guide to start your journey.

DSV has produced a maturity assessment tool to help you gauge where you are in the journey of bending your supply chain. No matter where you are (novice or expert or anywhere in between) the assessment tool will provide you a flightpath on where to go on your journey next. Whether you use it to benchmark where you think you are or access it to help start your journey, we know you will find it useful. To access this free tool simply email, learn more about the Circular Economy Maturity Assessment tool or some of the products and services featured in this paper then please contact

Vanessa Readhead
Business Development Director - Health
Vanessa.readhead@dsv.com

For media enquiries please contact

Vanessa Readhead
Business Development Director - Health
Marketing@uk.dsv.com

Authors

Vanessa Readhead

Business Development Director – Healthcare at DSV Solutions

With over 20 years of public and private Health Sector experience spanning patient advocacy and inclusion, clinical service delivery and supply chain logistics solutions. Vanessa also worked for Europe's largest waste and recycling organisation SUEZ, consulting with industrial and commercial businesses to connect develop sustainable solutions.

Bhav Somal

DSV Solutions Sustainability Manager for UK and Ireland

Driving with passion greener practices and eco-friendly solutions. Experience spans all aspects of Environmental, Social and Governance strategy and practices.

Expert Panel

Erik Van Wunnik

Director of Product Development at DSV Solutions

With over 25 years of experience in the logistics industry in production and logistics management. Combining engineering, design, program management, creativity, and imagination. A member of the Council for Logistics Know-How at Evofenedex, the Dutch Shippers Association, advising, connecting, and contributing to the logistics field and its best practices

Dr. Ryan Robinson.

Founder Aeropowder

After receiving his PhD from Imperial College London, Ryan founded a circular economy inspired startup that has created Pluumo - the world's first feather-based thermal packaging material for temperature-sensitive deliveries. Pluumo is designed to replace expanded polystyrene in supply chains and enable a more sustainable future. For his work, Ryan has been recognised by being featured on the Forbes 30 Under 30 List for Social Entrepreneurs and is an Echoing Green Climate Fellow.

Adrian Reynolds

Founder & Managing Director – Insynch Energy Services

With over 35 years has experience in project delivery, professional services and product development. Working with big petroleum, manufacturing, industry, leisure and food/beverage, providing consultancy. Project delivery spanning energy efficiency, carbon reduction, decarbonisation, procurement, grants and ESG.

Developed & delivered an award-winning nanotechnology product for chilled water, reducing energy consumption by around 12-15%.