Chemical Logistics Vision 2020

The next decade's key trends, impacts and solution areas

September, 2011

Introduction

The chemical industry is an important driver of the global economy, with estimated global annual sales of €1871 billion in 2009. The EU remains a leading chemicals production area, valued at €449 billion and accounting for 24 per cent of world chemicals production in 2009. Europe's share of the global chemicals production dropped however from 32 to 24 per cent between 1999 and 2009, due to stronger growth in other parts of the world.

Logistics are a key aspect of the chemical industry as production and consumption locations are mostly separated. Efficient, competitive and sustainable logistics are therefore of great importance for its future development. Logistics are typically quite agile, flexible and adjustable and as such, provide opportunities to respond to market changes quickly and effectively.

This report is the final output of a review initiated by the Strategy Implementation Group Logistics (SIG Logistics) of Cefic to create a vision of European chemical logistics over the next decade. This review started with a workshop on 18 October 2010, attended by 15 logistics managers from key players in the chemical industry and facilitated by Deloitte. The scope encompassed chemical logistics by all modes of transport in Europe. The future was depicted from three different perspectives: the chemical industry, the logistics industry and external factors (i.e. sustainability and regulations). The output from the workshop was then combined with the findings from the Deloitte Chemicals 2020 studies.The resulting draft report was reviewed at meetings of the Cefic SIG Logistics in February and June 2011.

The present report gives an overview of likely key trends in the next decade impacting chemical logistics as a whole. The solutions proposed provide food for thought to trigger further discussion on these issues. Likewise, it will help logistics managers in the Chemical and Logistics industry along the road towards 2020.

Source: Cefic Facts and Figures 2010 - The European Chemical Industry in a worldwide perspective

The purpose of this report is to describe the likely trends in European Chemical Logistics towards 2020

Purpose

- This report describes major trends and their impact on European Chemical Logistics based on historical evolution and likely future developments in the industry while taking account of external factors such as regulatory changes.
- This report should help shippers and Logistics Service Providers (LSPs) to reflect on the challenges ahead.
- The aim is to stimulate thinking about future developments in European Chemical Logistics. The described solution areas are only indicative and need further elaboration.

Recap of approach and findings of the Chemical Logistics Vision 2020

Approach

Cefic workshop

- Insights were gathered from three angles: chemical industry, logistics industry and external factors.

Deloitte's desk research

- To sustain the outcomes of the workshop and to create a starting point for future action, Deloitte performed desk research and combined this with the workshop's findings.

Follow-up

- The report provides an overview of relevant aspects within chemical logistics over the next decade. The intent is to trigger further discussion on the high level solution areas to overcome future challenges.

Findings

Key trends

- Product flows in 2020 will continue to evolve. The role of developing markets in production and demand will become increasingly important
- Continued clustering of European capacity
- Capacity constraints due to insufficient infrastructure, assets and capable operators
- More emphasis on emission reduction, safety and security from both the general public and politicians

Impacts

- Longer and more complex supply chains
- Higher logistics costs and constant pressure on transport capacity, shifting power between shippers and LSP's
- Increased regulation, focused on emission reduction and improvements in safety and security standards
- Demands for a responsible and sustainable approach to business

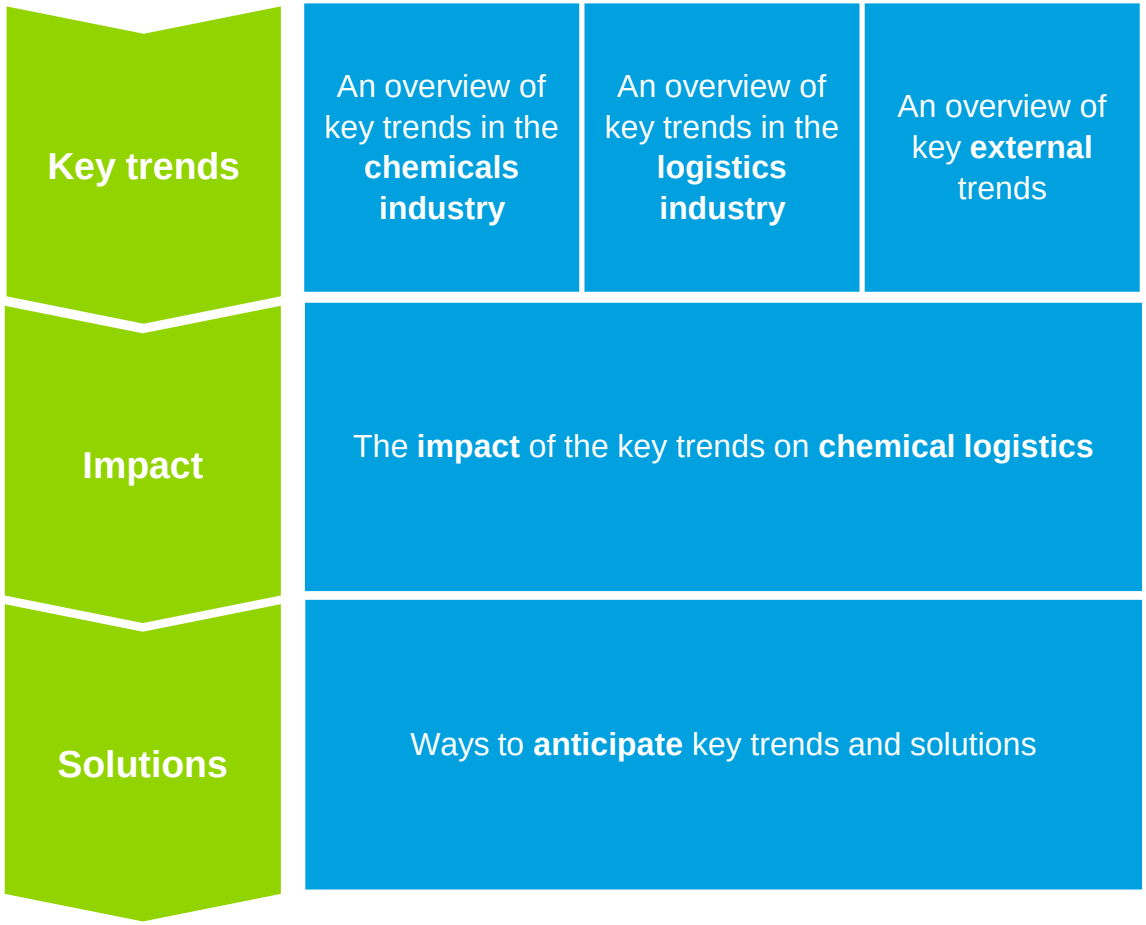
Solution areas

- Emergence of logistics agility as a solution is dependant upon many underlying drivers and enablers. The main objective is to balance costs, service levels, flexibility and sustainability. The report identifies four main solution areas:
  1. Greater horizontal and vertical integration along the supply chain to improve efficiency and productivity and ensure better asset deployment
  2. Increased focus on sustainable logistics strategies and concepts
  3. Continuous improvement in operational safety and security
  4. Further professionalization of the supply chain organization supported by training and process excellence

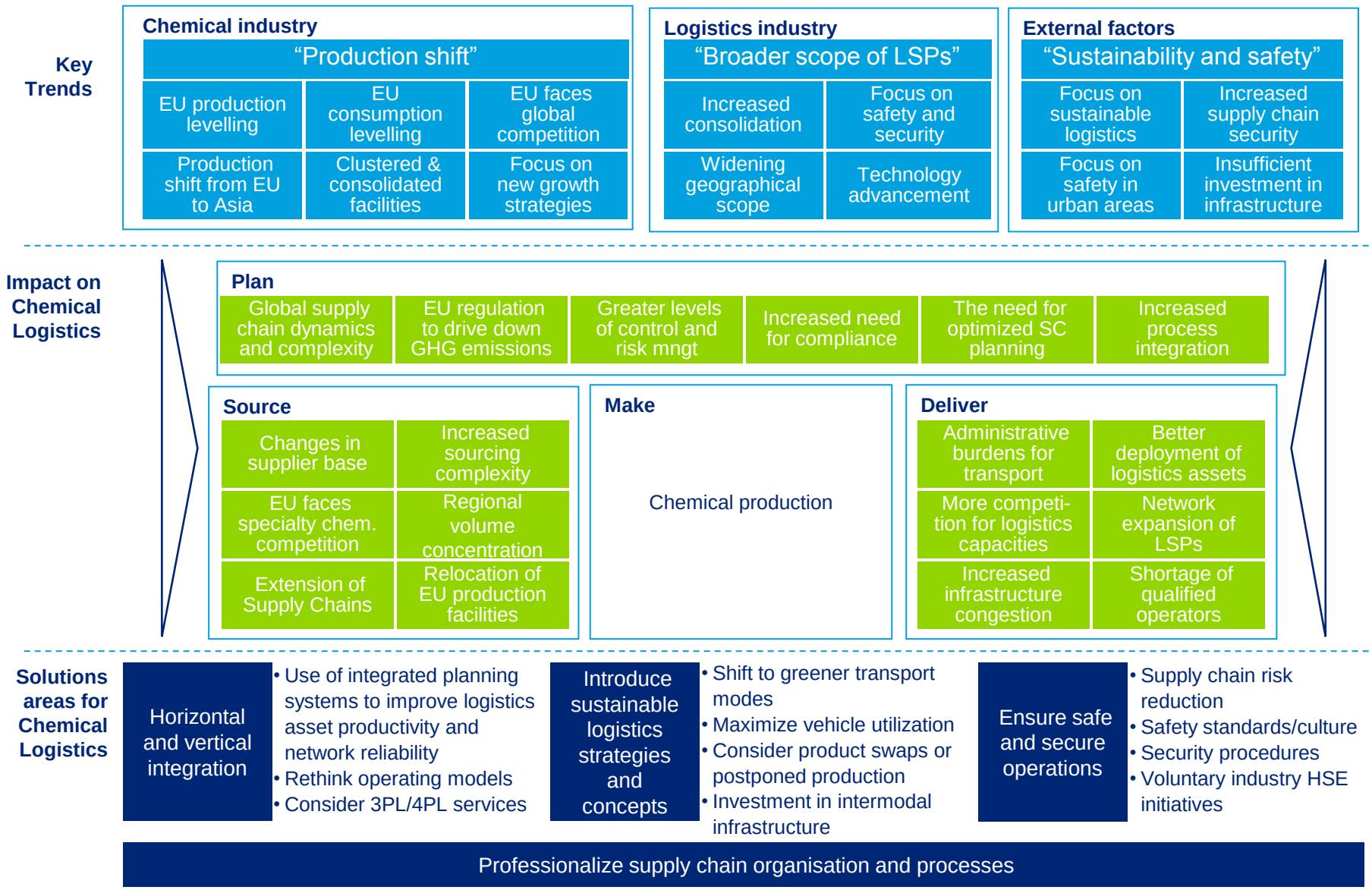
Key trends, impacts and possible solutions for European chemical logistics are formulated based on insights from chemical, logistics and regulatory fields

Set-up of the Chemical Logistics Vision 2020

- This report combines three separate perspectives into an integrated “Chemical Logistics Vision 2020”
- The three perspectives are:
  1. Chemical industry
  2. Logistics industry
  3. External factors
- The first part of the report formulates key trends and their impacts
- The second part of the report provides solution areas, which are expected to become increasingly important in the next decade



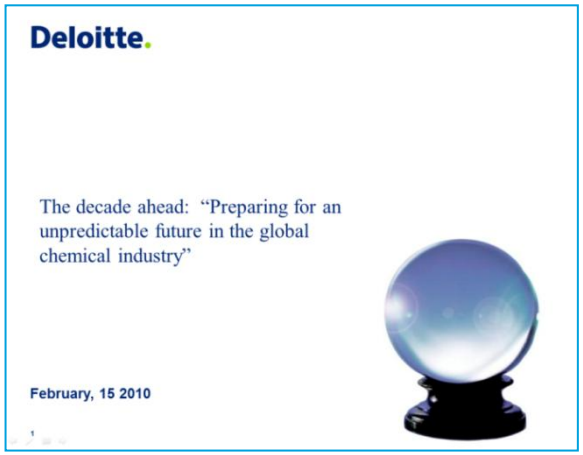
Cause and effect diagram for chemical logistics



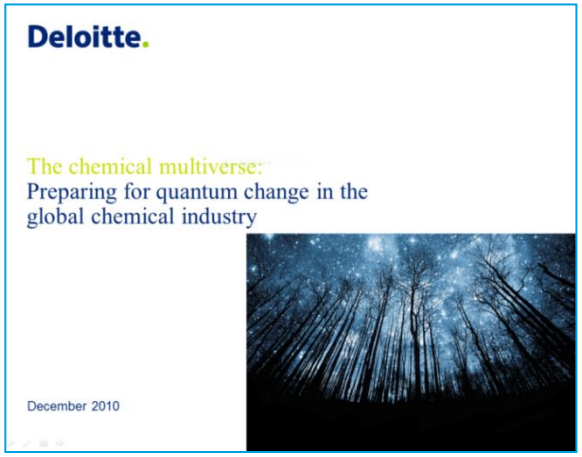
Key trends and impacts

Future scenarios for the chemical industry

The “Deloitte Chemicals 2020” reports analyse the future of the chemical industry in three different scenarios



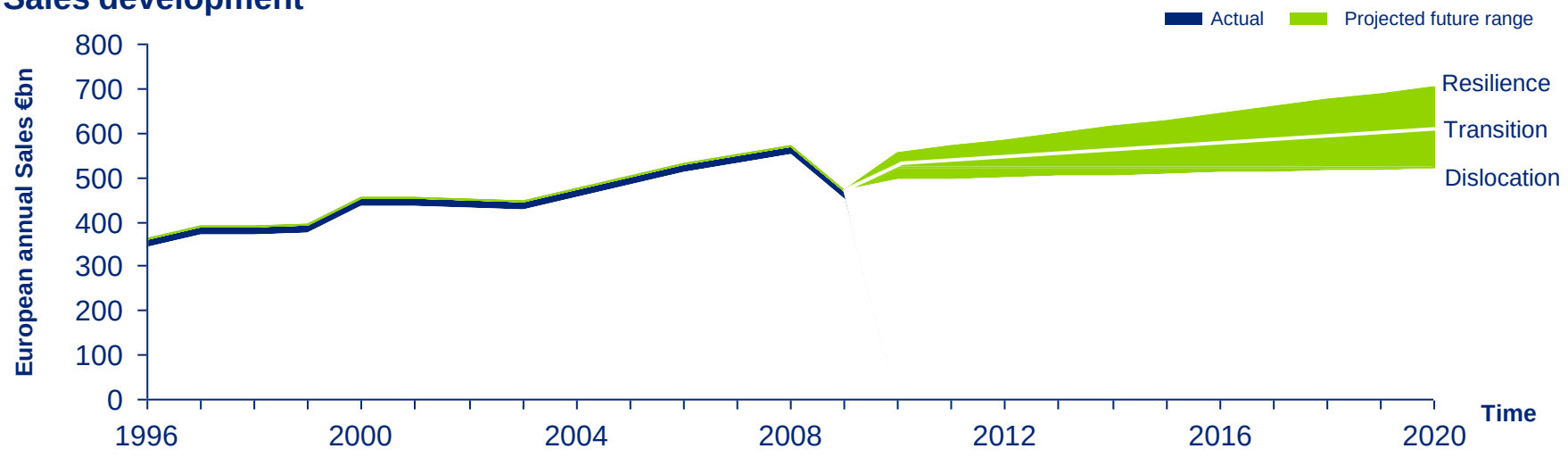
- This study summarizes Deloitte’s research on the chemical industry, including companies’ health, global key commodity capacities (including new capacities and capacity reductions), trends of innovation, policy and regulation, and the potential effects of global economic factors (GDP and price of crude oil)
- The study describes three potential scenarios for future development of the chemical industry, distinguishing between the industry’s opportunities and challenges in “developing” and “developed” markets
- Key conclusions:
  - The world economic crisis has led to a reset of both specialty and commodity markets, margin erosion and a change in end-use demand
  - Business model management and new growth opportunities are key in the next decade



- This study describes the changes over the last few decades for the chemical industry and the effect of different mega-trends
- While traditional market segmentation proved to be inadequate, alternative segments have been developed based on availability of financial resources and quality of business. This offers an updated view of today’s chemical market and better identifies a company’s position
- The study provides potential future scenarios for the chemical industry and articulates the new classification approach based on P&L and balance sheet metrics
- On this basis, an evaluation is made of what different players need to do to create a strategic path forward in the industry

Sales of chemicals in 2020 is heavily dependent on future demand scenarios

Sales development



- Chemical sales in the EU were €491bn in 2010
- In the coming decade three different scenarios can be considered (Deloitte Chemicals 2020):
  1. **Transition:** Economic growth shifts from West to East and energy efficiency is emphasized. In the West, boom-and-bust cycles persist throughout the decade. Western companies are deprived of attractive markets and placed at a disadvantage when competing for talent.
  2. **Resilience:** Success at restoring economic health boosts the G20's confidence, and leads to an era where international cooperation provides scope for national preferences and prerogatives. Green technology benefits from government policies that limit emissions and put a price on carbon.
  3. **Dislocation:** Slowdown in both developed and developing economies. The developing world suffers as demand for its exports declines.

Source: Cefic Facts and figures 2010, Deloitte Chemicals 2020 Cefic Chemicals trends reports Monthly summary September 2010, Discussions Cefic Workshop October 18 in Brussels, Deloitte analysis

Divergent views exist about market dynamics. Deloitte identifies three future scenarios in the chemical industry

Scenarios

Dislocation

Reset at a lower level across developed and developing worlds

Transition

Rebound in the developing world and reset at a lower level in developed world

Resilience

Rebound across developed and developing worlds

		Dislocation	Transition	Resilience
Economy (GDP)	Developed	2%	3%	6%
	Developing	5%	7%	9%
Regulation	Developed	Lenient — Stringent	Lenient — Stringent	Lenient — Stringent
	Developing			
Technology	Fossil fuel supply	Low — High	Low — High	Low — High
	Green emphasis			

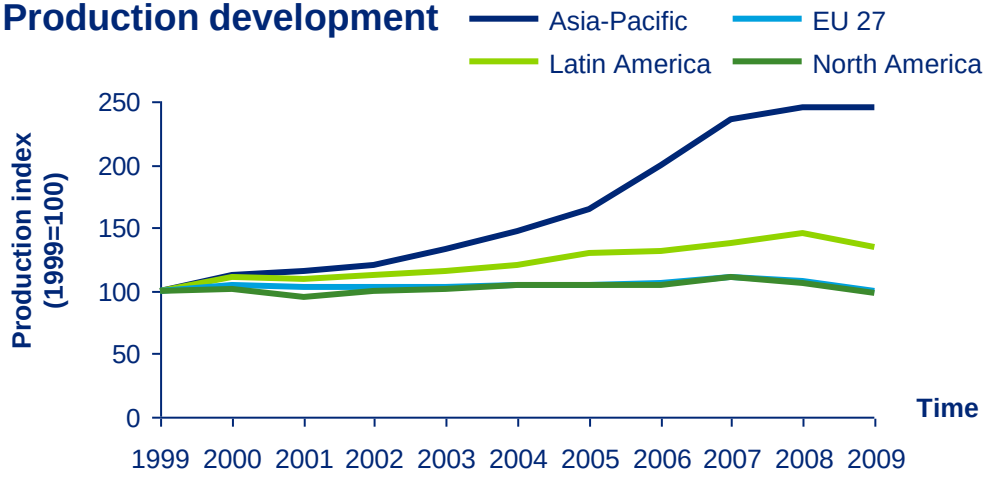
Source: Deloitte Global Manufacturing Industry Group analysis.

Chemical industry

Trends & impacts

In 2020, Europe's position is expected to be the same or worse than today due to "outdated" capacity, which is not replaced

Production development



- During the period from 2004 to 2009, the EU and North America chemical industry showed the lowest growth rate compared with the biggest regions in the world.
- Looking forward, the future scenario (transition, resilience, dislocation) will impact the development of the EU production capacity position, but is expected to remain the same or worse.

- European chemical industry faces additional pressure from competitors outside of Europe:
  1. From the Middle East where new petrochemical capacity is being built. A large proportion of its output will very likely find its way into European markets and China and the Middle East will contribute to 78% of new demand during 2009-2013. Countries expanding their production capacity by the addition of new facilities can avoid asset legacies and thus build 'greenfield' clusters.
  2. From North America where the development of unconventional gas production is increasing.
- Irrespective of additional competition, facilities for commodity products at the end of their life-cycle will likely not be replaced and assets will be reduced.
- The commodity chemicals are imported from the Middle East. The Middle East will remain a net exporter**,** with access to advantaged feedstock and significant government play in the market. The pace will depend on the scenario: resilience, transition or dislocation.
- Production levels of high-end, specialized products within EU are expected to keep up. However, China will become proficient in producing such products. This will impact exports to the Far East.

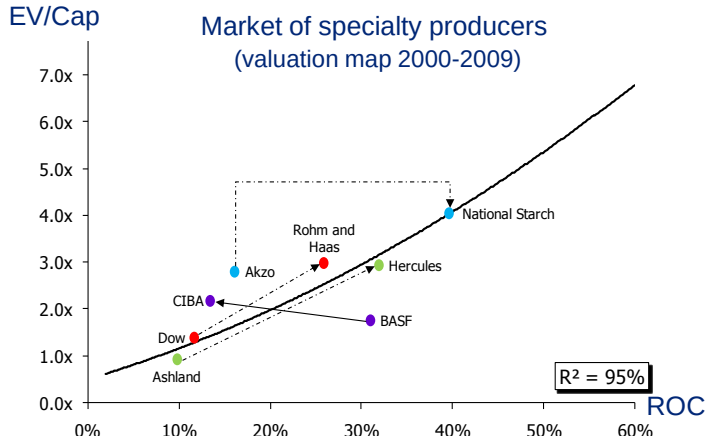
Note: 1. Asia-Pacific includes Japan, China, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Pakistan, Bangladesh and Australia
Source: Cefic Facts and figures 2010; Deloitte Chemicals 2020; Discussions Cefic Workshop October 18 in Brussels, Deloitte analysis

Chemical companies shift towards more hybrid business models due to M&A activities and product portfolio differentiation

1. There is a trend towards consolidation in the industry and companies aim to move to the correct side of the valuation map. Especially companies with a high return on investment (ROI) and high enterprise value (EV) compared to their capital (assets) are worth investing in. By acquiring these companies, profitable growth is enabled by business combinations that show a better return on capital (ROC).
2. Chemical companies pursue more hybrid business models. Thus, a clear segmentation between commodity and specialty producers disappears as the chemical industry consolidates, with a few large players offering multiple product ranges.

(Asian) M&A to gain higher ROC

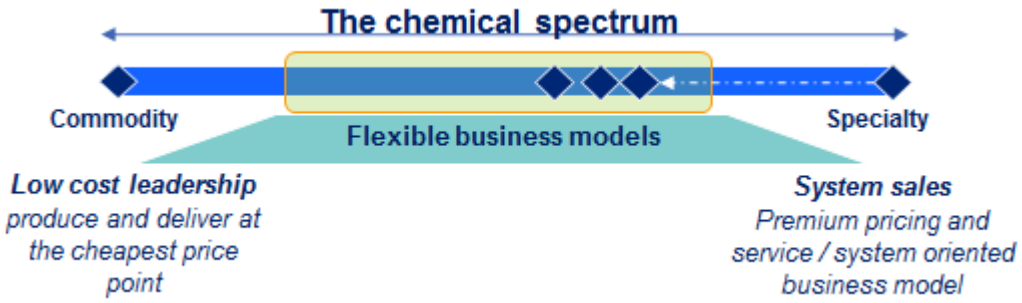
1



- Acquisitions are a necessary component of the growth and profitability strategy.
- Experts are predicting an increase in the M&A activity over the next decade, with companies in the West being likely targets and firms from West Asia and China being the buyers.

Product portfolio differentiation

2



- Provide only for what customers are willing to pay. However, do it without creating customer churn.
- Working with customers to understand the most cost effective business models.
- Understanding the nature and trajectory of products will help define clear and flexible business models as products move through the specialty to commodity cycle.

Source: Devon Value Advisors, Capital IQ and Deloitte Analysis
Economic Times, 3-2010

Production of chemicals and value added activities or customization of products received from the Middle East is executed in clusters

Current leading European clusters

Cluster in Europe based on size, importance on local economy and specialization:

High

Source: EPCA - The role of clusters in the Chemical Industry ;Cefic Facts and figures 2010; Deloitte Chemicals 2020; Discussions Cefic Workshop October 18 in Brussels, Deloitte analysis

Increased clustering of chemical industry

- There will be a continued trend to “cluster” production locations in the EU to ease dealing with:
  1. Emerging bottlenecks in transportation infrastructure
  2. Increasing cost of compliance (regulation on safety, security and sustainability)
  3. The viability of the European production facilities due to obsolescence
  4. Industry consolidation due to continued M&A activity
- The maturity of the current European clusters supports high productivity but it comes with a legacy of assets that now have to compete with facilities in Asia that can exploit potential economies of scale and new technologies to a higher degree
- Production in Europe will mainly focus on value added activities and customization of the products received from the Middle East

Opportunities for ports

- Enlargement of the European chemical imports is expected as capacity position may reduce
- Enhanced by the clustering this will generate new logistic flows into Europe
- This opens up opportunities for ports which are more land-focussed and eager to capture market share by investment in trans-shipment and storage facilities

The chemical industry will experience a production shift in the next decade

Key trends in the chemical industry

Stabilized EU production growth

- During the last decade the EU chemical industry showed the lowest growth rate of the biggest regions in the world. This is expected to continue in the next decade.

Levelled consumption

- Although chemical consumption is strongly dependent upon economic development, European demand is expected to level out in comparison with developing markets. This depends upon end use trends (e.g. automotive and housing become more important in developing markets) which clearly determine the evolution of the chemical industry.

Production shift

- Commodity facilities at the end of their lifecycle are not replaced and the European asset base will be reduced, relative to the world chemical production.
- Commodity chemicals are imported from the Middle East which will continue to increase as a net exporter. The US will be a net exporter enabled by the use of unconventional gas.

Global competition & regional specialisation

- China becomes capable of specialty production, impacting the EU share of chemical imports from and exports to the Far East.
- EU chemical industry faces additional pressure from competitors outside of Region, mainly from the Middle East where new petrochemical capacity is being built.
- To withstand global competition, mature chemical companies need to focus on internal value capture (i.e. working capital reduction) and new growth strategies (i.e. R&D) (*The decade ahead – Deloitte*).

Clustered facilities

- There will be a continued trend to “cluster” production locations in the EU.
- Strategic partnerships or mergers and acquisitions lead to consolidation of the industry.

The production shift in the chemical industry impacts the global chemical logistic supply chains and trade balance

Stabilized EU production growth

Levelled consumption

Production shift

Global competition

Clustered facilities

Impacts on chemical logistics

- **Increased supply chain complexity**

  The increase in imports from the ME and the resulting flows from EU sea ports to the clusters and final customers increase supply chain complexity of chemical producers (e.g. logistics management, planning, coordination). This is exacerbated by a focus on working capital reduction, leading to lower inventory levels and ultimately demanding further supply chain flexibility.

- **Regional volume concentration**

  Flat growth in EU production combined with clustered facilities in Europe results in a higher regional volume concentration within these clustered regions. This generates opportunities for non-traditional ports.

- **Supply Chain extension**

  The production shift leads to a change in the global trade balance and will lengthen the supply chain from suppliers via producers to customers. This results in a change in logistic flows and longer lead times for inbound materials.

Logistics industry

Trends & impacts

The logistics industry has evolved towards higher levels of system and process integration

From functional and fragmented activities to integrated logistics management

Initial technology

- Microcomputers emerge, allowing the first optimization models to be created
- Ad hoc solutions are created
- Companies begin to manage data

Production-driven logistics

- Supply chains organized into pre-production materials management and post-production distribution
- Required to invest in excessive inventory in response to poor and unreliable transportation
- Focus on maintaining production flow at all costs

Productivity enhancement

- Deregulation of transportation industry is catalyst for improving productivity – total logistics costs decline by 37%
- Warehouses and mfg. plants move from tracking labor productivity to asset productivity

Integrated systems

- Enterprise-wide technology platforms bring together companywide data and begin to remove functional silos
- Beginning of cross-functional supply chain organizations

Functional organization

- Transportation department separate from warehouse management and inventory management departments
- Back-office functions operated as transactional cost centres
- Shipper-carrier relationship same as buyer-supplier to obtain least cost for service

Asset-based networks

- Companies optimize locations and match assets to business needs largely based on deregulation of transportation industry
- Many own private fleets and distribution centres depending on mfg. location and distance from demand
- Logistics industry is highly fragmented and organized by mode of transport

Emergence of intermediaries (3PLs)

- Rather than being asset focused, 3PLs leverage people, process and IT
- Flexibility to manage freight movement by sharing transportation and distribution assets across shippers and carriers
- 3PLs are able to customize, enable and execute improved service at reduced costs

Continued evolution of logistics services

- Next generation of logistics service provider emerges as an asset-light, expertise-rich entity that leverages a network of asset-based service providers offering contract logistics in combination with freight management and execution (lead logistics services)

Different logistics outsourcing models exist, where applicability depends on the product type and SC characteristics

Logistics outsourcing models	Service offerings	Relationship & pricing models	Key attributes
Integrated Services	Integrated Services	• Partnership • Value Based	• Shared risk and reward • Strategic relationship • Broad supply chain expertise • Knowledge- and information-based • Advanced technology capability • Adaptive, flexible, and collaborative
Contract Logistics (CL)	Value Added Services	• Contractual • Risk Sharing	• Project management/contract management • Single point of contact • 3PL technology integration
Freight Management (FM)	Lead Logistics Services	• Contractual • Fixed and Variable	• Enhanced capabilities • Broader service offerings and geographies
Transportation Execution (TE)	Basic Services	• Commodity • Transaction	• Focused cost reduction • Niche services

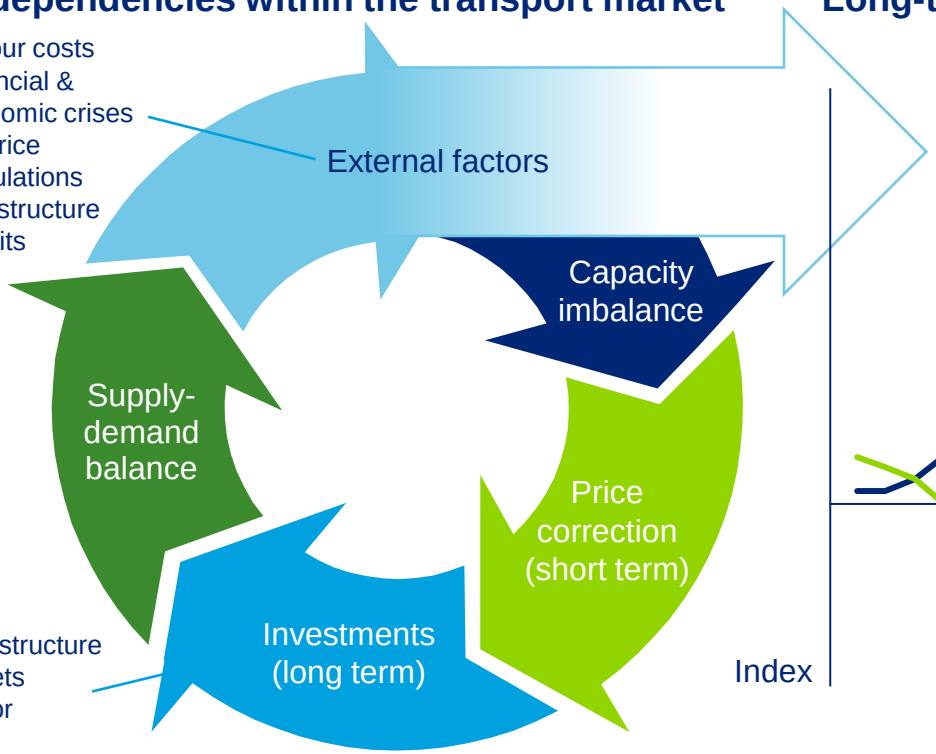
- Logistics models have evolved over time to address the changing needs of the market and vary, based on scope of service offering and degree of collaboration across the supply chain. The move towards integration ran at a lower pace in the chemical industry compared to others e.g. automotive.
- The suitability of each outsourcing model depends upon economies of scale, supply chain complexity, product portfolio, added value and shipment characteristics. These drive different weighting of selection criteria such as cost, responsiveness, flexibility, and risk.

Source: Third – Party Logistics: Results and Findings of 2009 Annual Study

Transport capacity naturally balances supply and demand. Freight rates are expected to increase in the long term

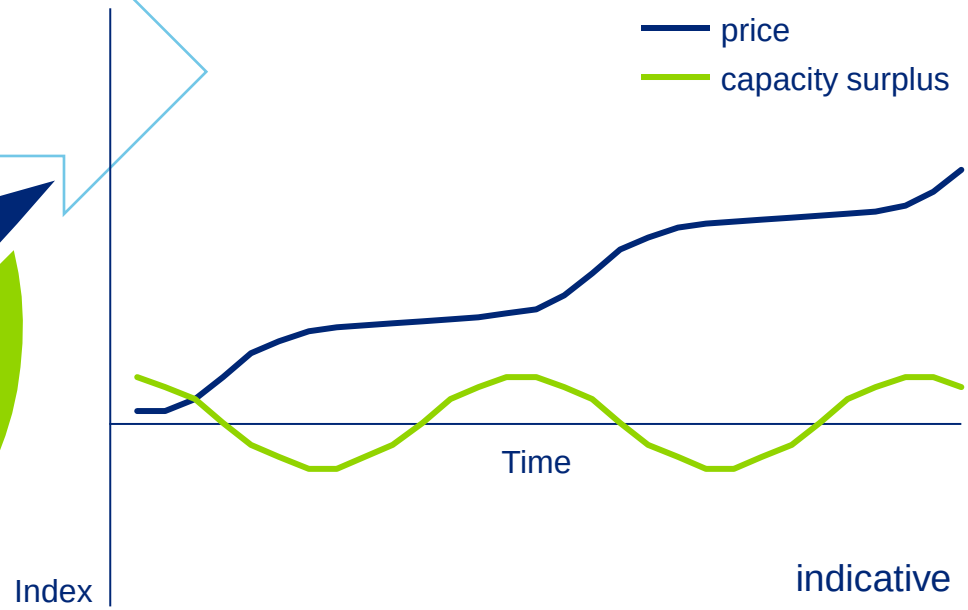
Interdependencies within the transport market

- Labour costs
- Financial & economic crises
- Oil price
- Regulations
- Infrastructure deficits



- Infrastructure
- Assets
- Labor

Long-term price and capacity development



- Transport capacity will be constrained in the short term, limiting flexibility and reliability of logistics networks.
- Short term price corrections do not solve capacity imbalances in the long run, therefore investments in assets, labour or infrastructure need to be made to re-establish the supply and demand balance.
- External factors like the financial & economic crises, oil price developments, changes in regulations and pressure from low cost labour can lead to new capacity imbalances.
- As shippers compete for constrained capacities, freight rates will rise, which in turn leads to logistics industry investments, easing or removing bottlenecks.

In the next decade the logistics industry faces a broader geographical scope and increased focus on high-end services

Key trends in the logistics industry

Capacity constraints

- Having come out of the economic crisis, LSPs are reluctant or unable to sufficiently invest in additional logistics capacities. Transport is seen as a commodity. The transport industry remains a highly fragmented low margin industry. The structural shortage of qualified truck drivers increases.

Increased consolidation and further sophistication of LSPs

- Mergers & acquisitions result in logistics firms that are capable of managing a broader geographic and functional supply chain scope.
- Shippers utilize logistics outsourcing to increase cost flexibility and responsiveness.
- LSPs move away from tactical transactional based services to solutions that are more strategic in nature and supported by advanced technology and systems.

Safety and security requirements

- Supply chain security and risk management will be a key area within logistics to prevent disruptions due to factors such as major transport accidents, labour issues, theft and terrorist threats.

Broader geographic scope

- Growth of EE and MEA markets requires deliveries over longer distances with poor infrastructure which results in increasing distribution costs and greater risk of supply chain disruption.
- Logistics services providers are required to expand and adapt their networks, develop new sub-contractors and/or invest in network expansion.

Technology advancement

- Rapid advances in supply chain technology enables increased functionality across multiple sites and countries and a greater potential to improve performance of supply chains (e.g. IT enabling real time tracking & tracing and supply chain visibility, complex multi echelon planning tools, cloud computing).

Logistics industry consolidation and further sophistication of LSPs enables new concepts, but capacities are likely to be constrained

Capacity constraints

Increased consolidation and further sophistication of LSPs

Safety and security requirements

Broader geographic scope

Technology advancement

Impacts on chemical logistics

- **Increased competition for logistics capacities**
  Chemical shippers compete for increasingly constrained capacities.

- **Better deployment of logistics assets**
  Consolidation of the logistics industry offers opportunities for both LSPs and shippers to achieve a higher level of integration. Effective adoption of sophisticated IT for better asset deployment, brings higher productivity, lower unit cost and better network performance.

- **Greater levels of control and risk management**
  Safety and security risks require greater levels of control and better risk management throughout the supply chain, which in turn offers improvement opportunities.

- **Logistics expansion as enabler for integration**
  The need for a greater network provides both challenges and opportunities to shippers and logistics service providers, driving further integration throughout the supply chain and the use of different transport modes.

- **Process integration as key success factor**
  The winners will be those that manage the increasing complexity through better process- and system integration, effective partnering along the supply chain and advanced technology deployment.

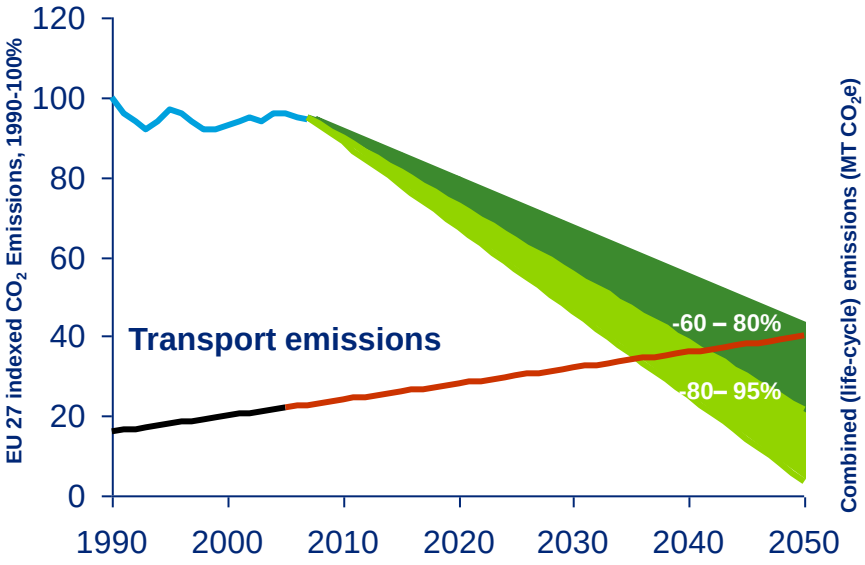
External factors

Trends & impacts

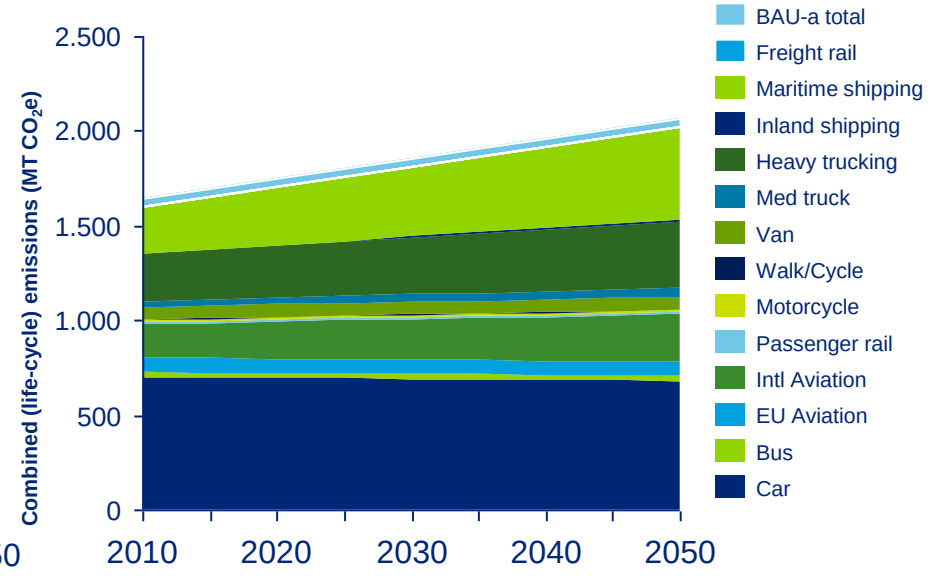
The urgent drive for Green House Gas emissions reduction will lead to further regulation of the logistics industry

External factors

Total GHG emissions (EU-27)



Total emission share by mode (in MT CO_2)



- Total Green House Gas (GHG) emissions of the EU-27 reduced slightly over the last two decades. Transport is the only sector where emissions are still increasing (1.4%/year-on-year) while 25% of all GHG emissions are caused by transport (and could reach 40% by 2020 if no actions are taken).
- More than 1/3 of all transport emissions originate from freight transportation. Shipping, aviation and road HGV are the fastest growing transport modes.
- To meet the EU 2050 GHG reduction goals (reduction of 60 to 95% by 2050), emissions from transportation must be significantly reduced. EU policy instruments will focus on technical, structural and demand reduction measures.
- Transport related emissions are expected to increase unless reduction measures are taken. Aviation will be included in the EU Emission Trading Scheme from 2012. Maritime transport might follow later. For road transport it is not yet clear which measures will be taken (e.g. fuel tax, road charging).

Source: European Environment Agency; Deloitte Chemicals 2020

External factors

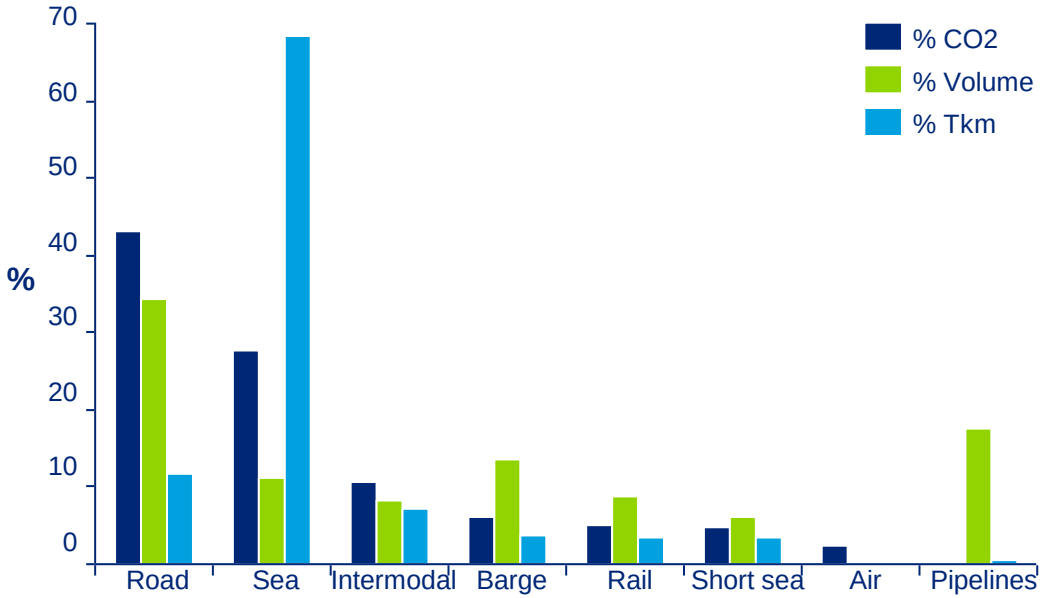
In chemical logistics, sea and road represent the biggest share in terms of tonne-kilometres as well as CO_2 emissions

Average transport emission factors

Transport mode	gCO_2/Tonne-km
Air	602
Road transport	62
Intermodal road / barge	34
Barge transport	31
Intermodal road / rail	26
Rail transport	22
Intermodal road / short sea	21
Short sea	16
Deep-sea container	8
Deep-sea tanker	5
Pipelines	5

Share of different transport modes in chemical logistics

(estimate based on Cefic survey with input from 12 major chemical companies)



- Maritime and pipeline transport is relatively “clean”, followed by rail, barge and road transport.
- Road and pipelines are the main transport modes in terms of volume. Sea and road represent the biggest share in terms of tonne-kilometres. Road and sea have the highest share of CO_2 emissions.
- Switching to greener transport modes and reducing the speed of transport with longer lead times will have an impact on chemical supply chains.
- A combination of many actions will be needed to reduce emissions.
- Introduction of carbon taxes or market-based measures (e.g. ETS) will increase the cost of transport.

Source: Alan McKinnon and Cefic

External factors

Since public and government perceive safety and security issues to be more important, moving goods will become more challenging

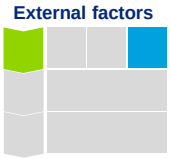
Underlying drivers

- Increasing urbanization and higher societal risk aversion in Europe leads to more focus on safety and environmental problems in urban areas
- Terrorism threats lead to stricter security regulations

External impacts

- Limitations on transportation of hazardous goods in urban areas
- Timeframes for transport overnight or during the day
- Limitations on routes and modes
- Extensive paperwork and time consuming procedures for trucks and containers to ensure secure operations at terminals and borders
- More creative solutions are required to overcome current challenges related to moving products.

From an external perspective, the focus on sustainability, safety and security will increase in the next decade



Key external trends

Sustainability regulation

- Since transport emissions represent a large share of total emissions, regulations will highly focus on reduction of transport related emissions.
- Carbon taxes and/or emission trading schemes will increase transport cost.
- Switching to greener transport modes and reducing the speed of transport will require changes to chemical supply chain models.
- Resource efficiency policies will drive reduction in use of natural resources for transport and more recycling will create new logistics flows

Security

- Terrorism threats lead to more focus on supply chain security. This affects the ease of movement of goods.
- Increasing vulnerability of supply chains as a result of piracy, theft and vandalism
- Authorized Economic Operator (AEO) status necessary to ensure less physical inspections and document checks and to reduce waiting time for security compliance.

Safety in urban areas

- Increasing urbanization and increased risk aversion of society lead to more focus on safety and environmental issues in urban areas. This may result in restrictions on the use of modes and routes (e.g. limitation of Hazmat transport and establishing (Hazmat) freight corridors).

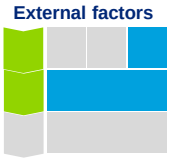
Congestion

- The increasing congestion of European transport infrastructure is increasingly burdening supply chain performance – current levels of infrastructure investments appear to be insufficient to accommodate the projected market growth and resulting transport demand.

Administration

- Additional safety, environmental and security regulations increase the administrative burdens for freight transport

The focus on sustainability, safety and security leads to regulations and restrictions that increase the challenge of moving goods



Sustainability regulation

Security

Safety in urban areas

Congestion

Administration

Impacts on chemical logistics

- **More legislation**
  Sustainability requirements from public and politicians grow. Regulations to deliver carbon emission reductions will increase logistics costs and require new supply chain models.

- **More stringent security procedures**
  Fear of terrorism leads to more security regulations at borders and in terminals and limitations on roads and modes. Extensive paperwork, time-consuming procedures, and congestion increase the challenge of moving goods.

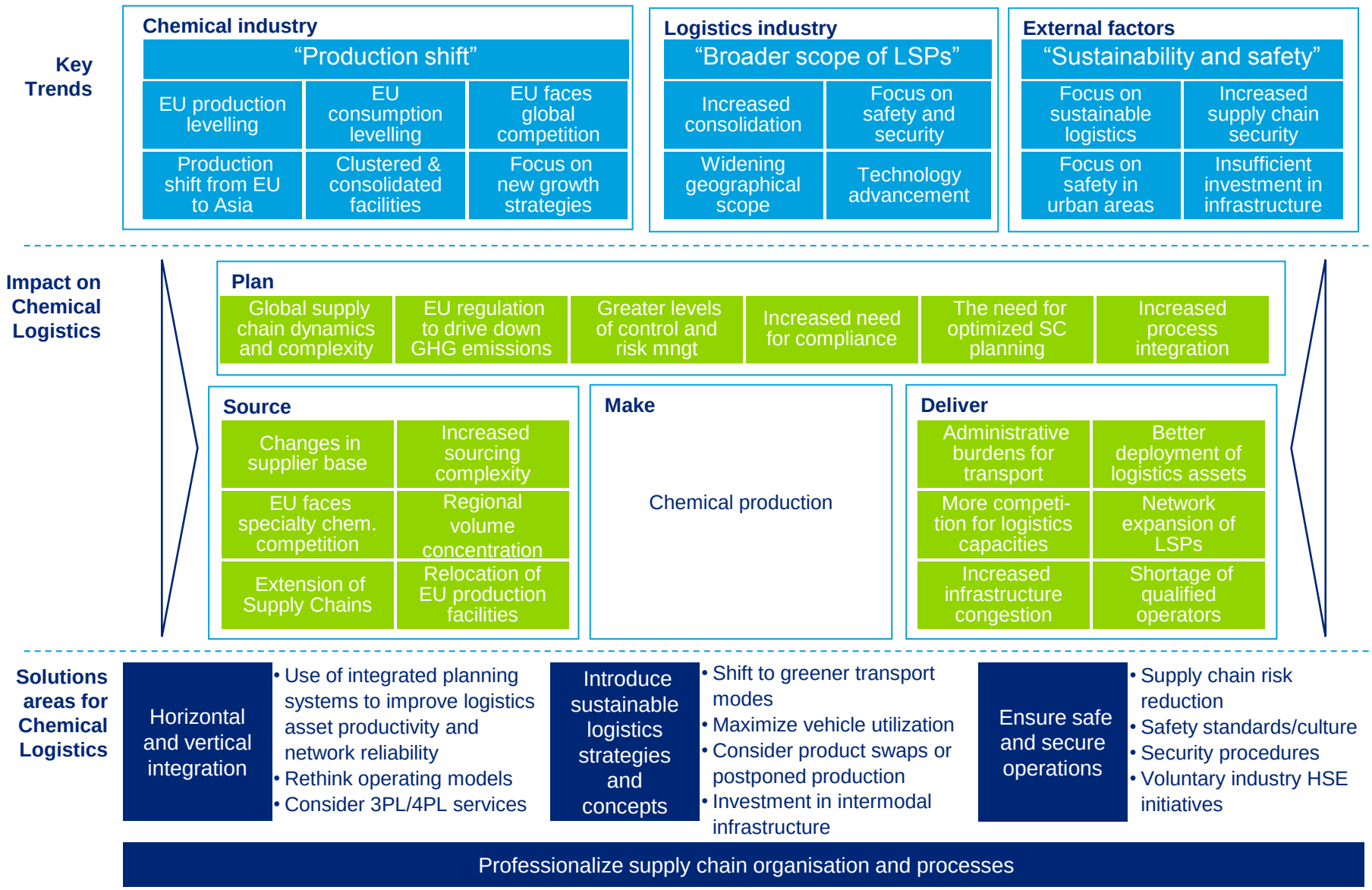
- **Higher safety standards**
  Further urbanization and the associated higher potential impact of accidents, will lead to more safety rules and restrictions on heavy good vehicles and hazardous goods transport.

- **Increasing congestion**
  Growing volumes without associated infrastructure investment will lead to further congestion in industrial clusters and port areas.

- **Administrative burdens related to transport**
  LSPs need to comply with additional regulations which drives additional waiting time and paperwork.

Solution areas

Cause and effect diagram for chemical logistics



Solution area

Improve horizontal and vertical integration along the supply chain in order to improve efficiency and productivity of asset deployment[1]

What does this mean more specifically?

Examples from other industries demonstrate that strategic alliances can be established through better process and system integration. Collaboration can be brought into play via a range of approaches:

(1) Horizontally between shippers:
Rather than competing for constrained network capacities there is an opportunity for shippers to bundle transport demand with other shippers and jointly develop freight corridors on strategically important routes and distribution platforms.

(2) Horizontally between logistics service providers:
LSP's may be able to complement each others networks, exchanging loads and sharing capacities, thus realizing higher productivity and overall improved reliability. A more robust integrated network would be better able to absorb peak demand and deliver associated economic benefit.

(3) Vertical collaboration between shippers, their LSP's, raw-material suppliers and customers:
Visibility of transportation demand is essential and vertical information sharing would allow improvement in production planning. This sets the basis for strategic and tactical network planning to ensure sufficient transport capacity to meet demand "in the right place at the right time".

What is driving this change?

- Continued cost and margin pressure on the logistics industry will drive further industry consolidation and increased sophistication in managing networks, in particular more sophistication in transport planning and network design.
- Chemical shippers, competing for access to capacity constrained networks, will seek the most capable LSP's, in particular those that can offer security of supply and access to flexible integrated supply chain platforms .
- Information sharing, for example, through independent secure hubs could be an enabler for exchange of logistics data such as forecast shipment volumes.
- Purchaser/Supplier relationships could progress from transaction based single-ERP interface towards collaborative planning through shared IT platforms.

What is the impact on chemical companies?

Chemical shippers should "re-think" their logistics operating model and move towards a more adaptable and scalable structure capable of coping with increased volatility and uncertainty. Increased integration is an enabler for improved supply chain visibility and can reduce uncertainty in the supply chain which allow safety stock reductions. They also need to evaluate opportunities to engage non-asset based LSP's, who emerge as there is a need to improve coordination of logistics networks .

Note: 1. Any actions to improve horizontal and vertical integration should be conducted in compliance with competition law rules

Solution area

Continue development of sustainable logistics strategies

What does this mean more specifically?

Environmental and economic objectives are not in conflict. The recently published White Paper "Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system" of the European Commission clearly underpins that "sustainable transport" and "competitiveness" are compatible targets. The challenges presented by the EC goals of lowering carbon emissions from transport by 60% by 2050 are an opportunity for shippers and logistics service providers to work together in order to increase the efficiency of our European logistics network. In doing so, shippers and LSP's need to put together strategies which encompass multiple generic concepts, for example:

(1) **Shift to "greener" transport modes:**
Development of intermodal solutions for journeys > 300 km to achieve the optimal balance between costs, service levels and sustainability .

(2) **Improvement of vehicle planning and utilization:**
Minimizing empty runs and increasing payloads leads to lower carbon emissions per tonne-km of goods moved as well as reducing costs. Horizontal and vertical collaboration supports this aim.

(3) **Product swaps or postponement of manufacturing steps:**
Product swaps can avoid transport or minimize unit intensity. Postponement can work for long hauls, where large shipments of semi-finished or higher concentration materials are transported for later finishing or dilution.

Authorities will need to invest more in new infrastructure to enable the increased use of other transport modes.

What is driving this change?

- Political and public pressure associated with the global climate debate, coupled with the chemical industry's commitment towards Responsible Care and sustainable development.
- EC policy to internalize external costs and launch of a range of policy measures to provide both positive and negative incentives to drive towards more sustainable logistics operations.
- The need to improve effective use of logistics infrastructure to offset increasing congestion.

What is the impact on chemical companies?

Competitive pressure to lower costs and environmental pressure to manage resources more sustainably, increases the importance of the supply chain. Finding the optimum balance between cost, responsiveness and sustainability is key to advance logistics solutions.

Continuous improvement in supply chain safety and security

Solution area

What does this mean more specifically?

- Relentless pursuit of supply chain risk reduction
- Continue safety programs (e.g. SQAS) to reduce risk of transporting (hazardous) goods
- Remain focussed on safe operational mind-set (e.g. safety culture programs)
- Supply chain visibility (including acquiring the Authorized Economic Operators status) to manage operational security
- Ensure a level playing field through harmonization of regulations and compliance across industry and geography
- Align safety and security commitment and capabilities of small, mid-size and large chemical and logistics companies with industry best practices
- Stress the importance of voluntary HSE initiatives (e.g. Responsible Care) in the chemical and logistics industry to improve the performance in the fields of safety, health and environmental protection, in addition to meeting legal requirements

What is driving this change?

- Increasing political and public pressure to reduce industrial risks to society and to eliminate all accidents, in particular in urban areas (increased risk aversion of society)
- Increasing urbanization
- Severe or frequent transport accidents may lead to even more stringent regulations and may put license to operate at risk
- IT capabilities enable increased visibility in the Supply Chain

What is the impact on chemical companies?

Continuous improvement of safety and security standards will remain a high priority for chemical companies. This will require close co-operation with logistics service providers and joint improvement programs . Stringent selection and continuous monitoring of the performance of logistics service provides will remain necessary.

Professionalize supply chain organisation and processes

Solution area

What does this mean more specifically?

- Improving organisational skillset, processes and IT is key to increased efficiency. This requires a strategic assessment of the structure and operating mission of the logistics function, for example an assessment of what activities should be organized centrally versus executed locally.
- A key enabler of supply chain professionalization will be the ability to effectively utilize the increased information flow for effective planning.
- Recruitment and development of supply chain professionals requires academic training, supported by both the Chemical sector as well as LSP's to secure talent in this field.
- Supply Chain managers face some of the next decade's largest challenges. This positions a career in the logistics field as one which offers many opportunities.

What is driving this change?

- The commercial environment continues to evolve rapidly. Organisations adapt their business strategies but often leave major elements of their logistics operating model unchanged. In order to achieve excellence in overall supply chain management, chemical companies have started to rethink their logistics model to bring support their business strategy.
- IT platform capabilities will expand further. Having the right skillset to run and optimize logistics must be developed and expanded.
- Horizontal and vertically integrated shippers and LSPs with interconnected global ERP systems and advanced planning functionalities will provide enormous improvements in visibility.

What is the impact on chemical companies?

Chemical companies should consider the full business value chain and obtain a clear view of how the operational components of an organisation are currently configured and function together to execute the business strategy. It should provide an end-to-end view across the significant elements of operational activity.

Appendix

Scenario 1: Dislocation – The worst path

Developing nations encounter trouble as they adjust to a slower pace of growth. Tenuous economic conditions temper energy prices and dampen support for new green technologies.

↓ Worse than today ↔ Same as today ↑ Better than today

	GDP growth	Capacity position	Projected demand	Investment type
Western Europe	↓	↓	↓	None
USA	↓	↓	↓	None
Japan	↓	↓	↓	None
China	↓	↓	↓	None
Middle East	↓	↓	↓	None

Issues	Status	Scenario conditions
Economy	Developed: Weak	Unresolved economic issues and growing fiscal burdens mean lackluster growth, but developed nations escape the upheavals underway elsewhere
	Developing: Weak	Reduced Western demand hurts developing nations. China and others try with only limited success to contain discontent via reform measures
Regulation	Developed: Stringent	Aggressive and complex ESH regulatory policies are among the factors impeding a sustained economic comeback
	Developing: Stringent	Regulatory controls are reduced, either because governments desperate for growth are experimenting with free-market solutions or due to instability
Technology	Developed: Low	Green tech fades as a priority, fossil fuel supplies are adequate given reduced demand and new supplies, and economic woes sap R&D funding
	Developing: Low	Science and technology lose out as programs are disrupted by adverse economic, social, and political conditions

Source: Deloitte Global Manufacturing Industry Group analysis.

Scenario 2: Transition – The current path

The East gains ground as the West suffers boom-and-bust cycles. Concerns about jobs and energy trump saving the planet. East and West address fossil fuel shortages differently.

Worse than today ⇔ Same as today ⇑ Better than today

	GDP growth	Capacity position	Projected demand	Investment type
Western Europe	⇔	↓	↓	Innovation
USA	⇔	↓	↓	Innovation
Japan	⇔	↓	↓	Status quo
China	⇑	⇑	⇑	Capacity innovation
Middle East	⇔	⇑	⇔	Capacity

Issues	Status	Scenario conditions
Economy	Developed: Weak	Developed nations endure boom-and-bust episodes, unable to settle on policies to deal with the post-recession challenges
	Developing: Strong	China works to form an Asia-Pacific block, pulling not only India and other developing nations into its orbit but Japan and Australia as well
Regulation	Developed: Lenient/ Stringent	Concerns about losing more jobs cause developed nations to moderate the intensity of their regulatory initiatives affecting ESH* and other areas
	Developing: Lenient	Concerns about creating more jobs causes developing nations to moderate the intensity of their regulatory initiatives affecting ESH* and other areas
Technology	Developed: High	Oil and gas production peaks, and cutting energy use is imperative. Net energy ROI affects the choice of substitutes for conventional fossil fuels
	Developing: Low	China and its allies focus on securing access to oil and gas. Work on alternatives proceeds but not with the vigor found in the West

Source: Deloitte Global Manufacturing Industry Group analysis.

Scenario 3: Resilience – The better path

Success at restoring economic health boosts the G20's confidence, and leads to an era mixing international cooperation with leeway for national preferences and prerogatives.

Worse than today ⇔ Same as today ⇑ Better than today

	GDP growth	Capacity position	Projected demand	Investment type
Western Europe	⇑	⇔	⇔	Innovation
USA	⇑	⇔	⇔	Innovation
Japan	⇔	⇔	⇔	Innovation
China	⇑	⇑	⇑	Capacity Innovation
Middle East	⇔	⇑	⇔	Capacity

Issues	Status	Scenario conditions
Economy	Developed: Strong	Enthusiasm for free-market policies fades as developed nations find that the judicious application of government power can be effective
	Developing: Strong	China's government-led model continues to produce results and attract adherents. A switch from exports to consumption gradually gains traction
Regulation	Developed: Lenient/ Stringent	Public support for greater ESH regulation, intensified by growing evidence of climate change, stimulates mandates, prohibitions, and incentives
	Developing: Lenient/ Stringent	Tighter ESH controls result from the demands of the rising middle class, reactions to climate change impacts, and Western financial support
Technology	Developed: High	Renewables are popular as oil infrastructure undergoes a long period of catch-up and natural gas is the alternative of choice for transportation fuel
	Developing: High	Renewable energy and other alternative fuels receive attention, but nanotechnology innovation is seen as crucial to international leadership

Source: Deloitte Global Manufacturing Industry Group analysis.

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