

# Supply Chain Excellence in the European Chemical Industry



## Results of the EPCA-Cefic Supply Chain Excellence Think Tank Sessions

organised and sponsored by EPCA  
in cooperation with Cefic



The European Petrochemical Association

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# CONTENTS

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Executive summary

1. Introduction

2. Dimensions of Supply Chain Improvement

3. The European Chemical Industry and Supply Chain

4. Supply Chain Challenges

5. Supply Chain Improvements

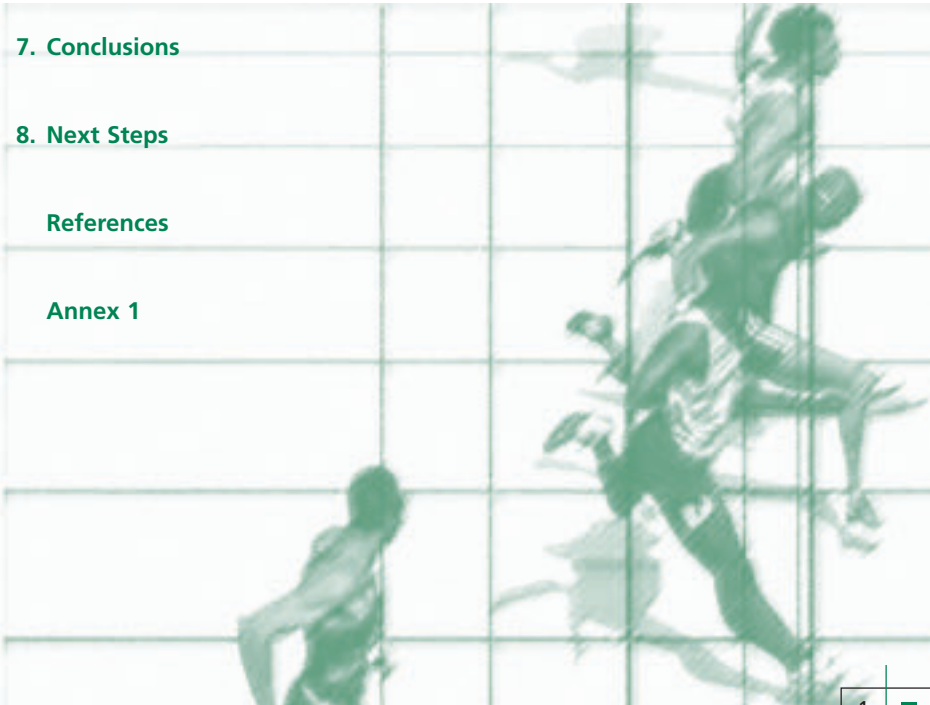
6. Role of the EU and National Governments

7. Conclusions

8. Next Steps

References

Annex 1





## Executive Summary

This report summarises the results of a series of ‘think tank’ discussions on the future of the European chemical supply chain convened by EPCA and Cefic. The initiative was prompted by growing concern about competitive threats to the European chemical industry. The industry’s share of the global chemical market is likely to decline as a result of the rapid growth of chemical production in Asia-Pacific countries and the Middle East. For example, it has been predicted that over the next decade their annual growth rates for ethylene production will be, respectively, 3.5 and 8.5 times faster than that of the EU.

The intensification of competition in the global chemical market will force European producers to find new ways of improving efficiency and service quality. As the scope for further efficiency gains in the production process will be limited, the supply chain is likely to become the main source of future cost savings.

These savings will nevertheless be difficult to secure because, at the same time, supply chain costs will be subject to several inflationary pressures. Transport infrastructure is becoming increasingly congested, fuel and labour costs are rising, downstream supply lines are lengthening, customers are demanding shorter order lead times and environmental and safety controls on the distribution of chemicals are steadily tightening. National governments and the EU are also committed to internalising more of the environmental cost of freight transport in higher taxes. The resulting increases in transport costs will impact more heavily on those sectors, such as chemicals, which are relatively transport-intensive, rely heavily on road transport and spend an above-average share of sales revenue on transport.

A series of measures are proposed which collectively could transform European chemical supply chains. They would not only offset the upward cost pressures, but also enable companies to offer a superior distribution service more cost-effectively.

Some of these measures, such as the rationalisation of product ranges, improved functional co-ordination and transport modal shifts, could be implemented by individual companies working independently. The vast majority, however, would require inter-company collaboration. Some would involve collaboration along the

vertical supply chain and result, for example, in an increasing proportion of chemicals being dispatched in bulk loads, more effective application of the cost-to-serve principle, greater reliance on vendor managed inventory and the relaxation of the monthly payment cycle.

Other measures would need horizontal collaboration between similar firms at a particular level in the chain. These would include the development of swap arrangements, the pooling of logistical resources and co-ordinated action to improve the level of supply chain skills in the chemical industry.

Logistical service providers would have a crucial role to play in the implementation of most of the proposed actions. Many of the LSPs serving the chemical industry are small businesses that can deliver a reliable service at reasonable cost, but often lack the resources, expertise and incentive to provide innovative supply chain solutions. The report examines ways in which stronger, mutually-supportive relationships can be fostered between chemical companies and LSPs.

Given the enormous contribution that the chemical industry makes to the European economy in terms of output, employment, downstream linkages and international trade, the EU and national governments have a vital interest in ensuring that the distribution of chemicals remains competitive. They can assist this process through the continued liberalisation of freight markets, particularly for rail, short-sea shipping and inland waterways, enhanced support for intermodal transport, the standardisation of equipment and ICT networks and the upgrading of transport infrastructure. The chemical industry should be ready to take advantage of the EU's expanded Marco Polo II programme which aims to facilitate the transfer of freight to rail and water-based modes.

In summary, the long list of supply chain improvement measures identified by the think tank group fall under six general headings: collaboration, segmentation, co-ordination, system optimisation, standardisation and liberalisation. Many of the measures are mutually reinforcing and, if implemented as part of a package of supply chain improvements, could yield major economic and environmental benefits. Some will, nevertheless, require fundamental changes in business processes, trading practices and managerial mindsets.

The report outlines a series of steps which the industry can take to progress this initiative and promote the implementation of the improvement measures. A 'road-map for action' has been compiled comprising five tracks, each of which will require a 'champion' and supporting team of industry specialists. Companies and individuals are strongly encouraged to support this programme and ensure that European chemical supply chains are restructured to meet the impending competitive challenges.



# 1. Introduction

The Supply Chain Excellence initiative was established jointly by the European Petrochemical Association (EPCA) and the European Chemical Industry Council (Cefic) in December 2003. This industry-wide initiative has had three principal goals :

- to examine opportunities for using supply chain management to increase the long-term competitiveness of the European chemical industry
- to learn lessons from supply chain best practice in other sectors
- to recommend changes to the design and operation of European chemical supply chains

Over the past decade, many chemical companies around the world have overhauled their production operations. In Europe, the scope for further cost reduction in the production process is now limited, given the size and age of much of the plant capacity. There, nevertheless, remains significant potential for improving the efficiency with which chemical products are distributed. Indeed, few other activities offer as much potential for cost reduction. Realising this potential may not be easy, but competitive conditions in the global chemical market will force European producers to make radical changes to their supply chains. It has been suggested that supply chain productivity improvements of 3-5% per annum may be required to maintain the competitive position of the European chemical industry. This creates a compelling case for change.

Supply chain costs represent an average of 8-10% of sales revenue for chemical companies<sup>(1)</sup>. They represent a much higher proportion of the net value added. At roughly 37% of value-added in the chemical industry, supply chain costs are significantly more important than in other industrial sectors, such metal products, building materials, automobiles and paper where the equivalent percentages are, respectively, 18%, 26%, 28% and 30%<sup>(2)</sup>. This reflects the relatively low value per tonne of chemical products and relatively high costs of moving and storing them, given their bulky and hazardous nature. It also highlights the need for supply chain issues to be given greater priority within the chemical industry.

A 'think-tank' was set up comprising senior supply chain managers in large chemical companies and other logistics specialists to examine these issues (Annex 1). This group has taken a medium to long-term view of the development of the chemical supply chain, looking forward 10-15 years. It has adopted a broad perspective on the supply chain challenges facing the industry. A wide range of economic, industrial, environmental and technological trends has been examined and forecasts made of their likely impact on the chemical supply chain. In the true spirit of supply chain management, particular emphasis has been placed on collaborative initiatives involving producers, their customers and logistics service providers. Consideration has also been given to the role that government can play in either facilitating or inhibiting supply chain improvement.

For the purposes of this study, the US Council of Logistics Management's definition of supply chain management was adopted<sup>(3)</sup> :

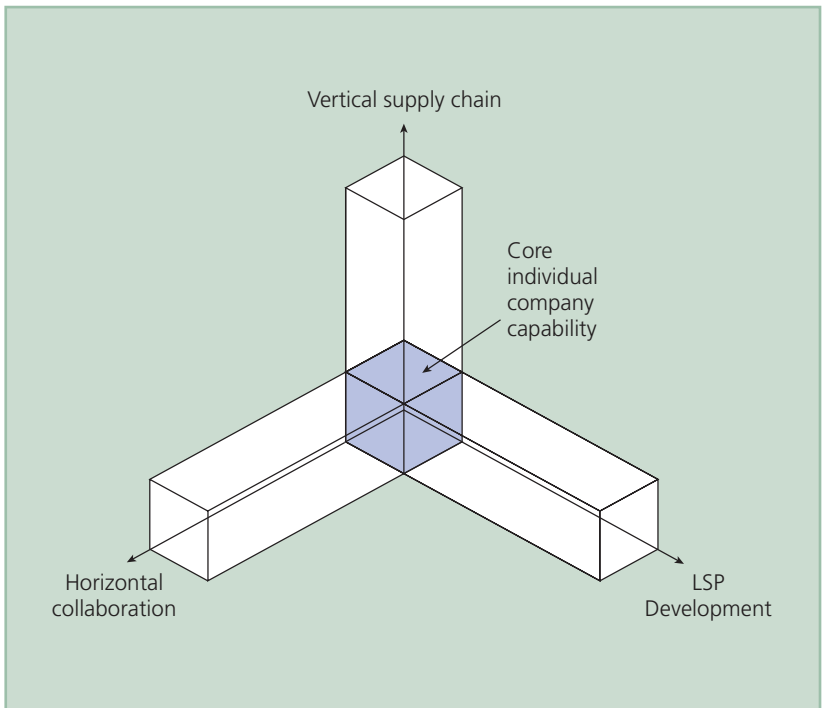
*'Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes co-ordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies.'*

Within this context, 'logistics management activities' comprise transport, warehousing, inventory management, materials handling and related information processing. It is important to emphasise that logistics involves much more than the physical movement of products.

Attention has focused on supply chains downstream of chemical plants and has not considered the inbound flows of feedstock.

## 2. Dimensions of Supply Chain Improvement

The think-tank found it useful to conceptualise the proposals within a four-dimensional framework (Figure 1). Some measures could be implemented by individual companies working independently. The vast majority, however, would require inter-company collaboration. This could take place along the vertical supply chain and involve co-operation between producers, distributors and / or customers. Some initiatives would need horizontal collaboration between similar firms at a particular level in the chain. The fourth dimension represents the relationship between companies at any stage of the supply chain and logistics service providers (LSPs). LSP's would have a crucial role to play in the implementation of most of the proposed actions.



**Figure 1: Dimensions of Supply Chain Improvement**





### 3. Nature and Scale of the European Chemical Industry and Supply Chain

The EU has the largest chemical industry in the world. In 2003 it accounted for just over a third of total global chemical production, worth 556 billion Euro. Of the thirty largest chemical companies in the world, fifteen are headquartered in Europe and they collectively account for 29% of global chemical sales. The industry contributes roughly 10% of value added by manufacturing in the EU and 2.4% of its gross domestic product<sup>(4)</sup>. Approximately three million people work in the industry, 12% of all manufacturing employment in the EU<sup>(5)</sup>. The industry is also unique in supplying virtually every other sector of the economy with essential materials (Table 1). The competitiveness of all these other sectors is partly dependent on the efficient supply of chemical products. It is for this reason that the chemical industry has been described as the ‘anchor’ of a modern economy.

**Table 1 : Distribution of Domestic Consumption of Chemicals in the EU**

	<b>% of Domestic Chemical Consumption</b>
Consumer products	30.3
Agriculture	6.4
Textiles and clothing	6.3
Construction	5.4
Automotive	5.3
Paper and printing products	4.5
Electrical goods	3.9
Metal products	2.5
Industrial machinery	1.9
Office machines	0.7
Rest of manufacturing	6.1
Rest of industry	10.3
Services	16.4

Source: Cefic<sup>(6)</sup>

Over the past twenty years the European chemical market has become more fully integrated, with the proportion of sales confined to national markets declining and the proportion of cross-border sales sharply increasing. Between 1993 and 2003 the share of domestic sales plummeted from 55% to 25%, while the proportion of intra-EU business rose from 27% to 46%<sup>(7)</sup>. This has had a significant effect on chemical logistics. As the geographical distribution of production capacity has changed little, products have had to be moved over greater distances. This was facilitated by the formation of the Single Market and liberalisation of international road haulage operations in 1993, though mounting congestion on European transport infrastructure is now making these longer hauls more expensive and less reliable.

An increasing proportion of EU-produced chemicals are being exported to other parts of the world. This has risen from 18% in 1993 to 29% in 2003<sup>(8)</sup>. Chemical producers have had to develop their international distribution networks to accommodate this growth. The value of extra-EU exports far exceeds the return flow of imports: in 2003 for every 1bn Euro of chemicals imported, 1.85bn Euro worth was exported. The chemical industry's trade surplus in fact accounted for 45% of the EU's total manufacturing trade surplus in 2002<sup>(9)</sup>. The ability of European chemical companies to sustain this position and continue to make a vital contribution to the EU's international trade balance will partly depend on the competitiveness of their global supply chains.

In summary, changes in the pattern of trade both within Europe and globally have had the effect of lengthening supply lines and generally making the production and distribution of chemicals more transport-intensive.



## 4. Supply Chain Challenges

The early think tank discussions reviewed external trends and developments likely to influence the chemical supply chain. These were grouped under six headings following the conventional PESTEL approach to market analysis : political, economic, social, technological, environmental and legal :

### Political

- Enlargement of the EU
- Liberalisation of the European rail, port and shipping markets
- Government support for transport infrastructure and services

### Economic

- Future availability and price of oil
- Erosion of the customer base to Eastern Europe and the Far East
- Competition from chemical imports from other regions
- Changes in consumer demand
- Variable economic and financial conditions

### Social

- Changing social legislation on recruitment, dismissal, working-hours etc.
- Shortage of staff with required skills
- Changes in the public image of the chemical industry

### Technological

- Development of e-business networks
- Advances in information and communication technology
- Diffusion of scanning and tracking devices
- Development of business software

### Environmental

- Internalisation of the external costs of freight transport
- Tightening environmental controls on logistics operations
- Increasing terrorist threat / tightening of security
- Increasing congestion on European transport infrastructure

## Legal

- Proliferation of laws, regulations and directives
- Increasing complexity of business law
- Growth of the 'compensation culture'

These factors can influence the management of the chemical supply chain either directly or indirectly through their effect on products, the production process, the customer base and structure of marketing channels. From this list, five major challenges were identified as likely to have an important influence on supply chain management in the European chemical industry over the next decade:

### 4.1 | External competition from lower cost producers

As a result mainly of the rapid expansion of the chemical industry in Asia-Pacific countries, particularly China, and the Middle East, the share of the global market held by European producers is likely to diminish. It has been predicted that between 2002 and 2015, Ethylene production in the Middle East and Asia will expand, respectively, 10.1% and 4.2% per annum, by comparison with an annual growth rate of only 1.2% in Western Europe<sup>(10)</sup>. Middle Eastern producers will be able to exploit their feedstock advantages, while in the Far East the buoyant growth of manufacturing, much of it 'off-shored' from North America and Europe, will drive the expansion of the chemical sector. New cracker capacity being constructed in these regions is in much larger and more technically advanced plants that can achieve significantly lower unit costs than their European counterparts. To remain competitive in export markets and minimise import penetration into the European chemical market, companies producing chemicals in Europe must continue to cut their costs. As the scope for further reductions in production costs is limited, given the age, size and locations of European plants, much of the cost saving will have to accrue from improved supply chain management.

Inter-regional comparisons suggest that opportunities exist to cut European supply chain costs. It has been estimated, for example, that the cost of distributing a tonne of commodity plastics in Europe is around 59 Euro, approximately 12 Euro per tonne higher than in the US, despite the fact that the average length of haul for chemical products is much greater in North America and labour costs significantly higher<sup>(11)</sup>. The cost differential appears to be due in part to the much higher proportion of plastics in Europe sold in packaged rather than bulk form and the much greater reliance on rail for long haul transport in North America. Section 5 explores how this cost differential could be narrowed.

## 4.2 | Changing customer requirements

The European customer base is steadily eroding as large users of chemicals relocate their production to lower labour cost countries in Eastern Europe and the Far East. Retaining these customers involves extending the supply lines and providing a distribution service over long distance which is competitive with local producers. This is made even more difficult by customer pressures to reduce order lead times and provide delivery within narrower time-windows. As the chemical industry in the Far East expands, it will not only enjoy lower production costs, but will also benefit from supplying domestic customers over relatively short distances.

## 4.3 | Increasing congestion on European transport networks

It is projected that there will be a steady increase in the level of road traffic congestion across Europe. The European Commission has forecast that the overall cost of traffic congestion will increase by 142% between 2000 and 2010 to reach 80 billion Euro, equivalent to 1% of the EU's gross domestic product<sup>(12)</sup>. This will not only increase average transit times; as capacity limits are reached across much of the network, delivery reliability will decline, reducing service quality and inflating transport costs. As a very high proportion of European chemical traffic currently moves by road (Table 2), the industry will be particularly exposed to this adverse trend.

**Table 2 : European Modal Split for Chemicals (2001)**  
*(excluding pipelines and short-sea shipping)*

	% of tonnes-lifted		
	national	international	total
Road	92	68	89
Rail	6	13	7
Inland waterway	2	19	5

Source : Eurostat<sup>13</sup>

In 2001, chemicals accounted for 5% of freight tonnes lifted in the EU and around 8% of tonne-kms<sup>(14)</sup>. Their share of cross-border freight tonnage was roughly twice as high, reflecting the high volume of intra-EU trade in chemicals. The relatively high transport-intensity of the chemical industry is also revealed by average length of haul statistics. Consignments of chemicals move an average

of 114 km on the road network and 386kms on the rail network, whereas for all commodities the average hauls are respectively 77 and 214 kms<sup>(15)</sup>. The chemical industry will therefore be more exposed to congestion problems on European transport infrastructure.

## 4.4 | Tightening environmental control

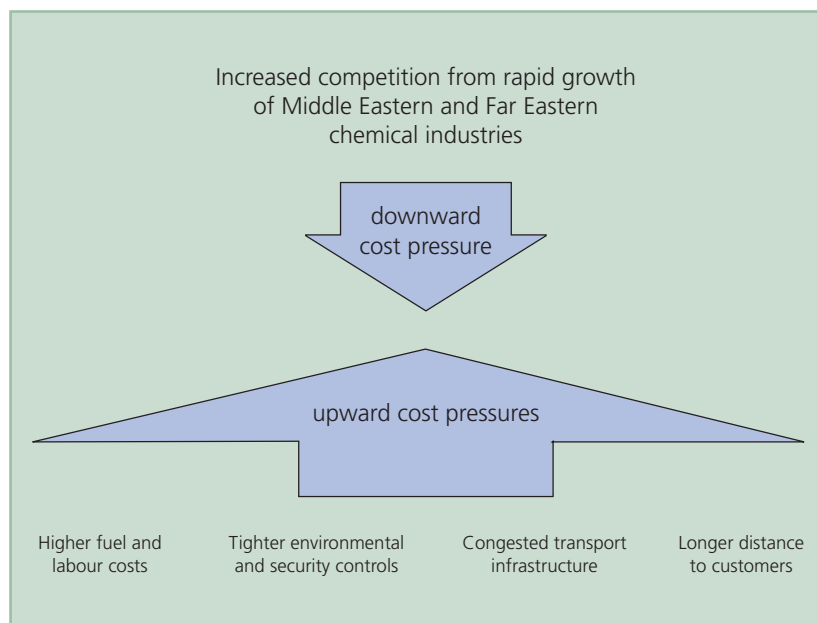
Environmental controls on the movement of all types of freight are steadily tightening. Governmental organisations have suggested that current taxes on freight transport, especially by road, would have to rise significantly to fully recover environmental costs<sup>(16)</sup>. Governments are particularly concerned about the projected growth of CO<sub>2</sub> emissions from the freight transport sector. It is likely, therefore, that taxes on freight movement will rise. The resulting increase in transport costs per tonne-km will impact more heavily on those sectors, such as chemicals, which are relatively transport-intensive and spend an above-average share of sales revenue on transport. The European chemical industry has already achieved impressive reductions in CO<sub>2</sub> emissions within the production operation. Between 1990 and 2002, these emissions were reduced 9% while total output expanded by 43%<sup>(17)</sup>. Over the next decade, tightening environmental controls will force companies to reduce the carbon intensity of their supply chains.



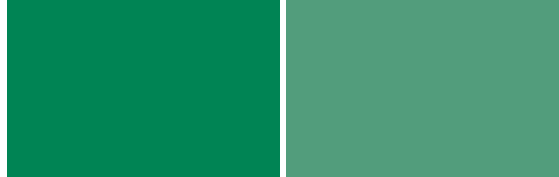
## 4.5 | Increasing safety and security concerns

The new security measures being introduced by governments around the world in response to the terrorist threat have a particularly strong bearing on the chemical industry, given the hazardous nature of its products. Many of these measures relate specifically to the physical distribution of the products.

The picture that emerges is of an industry subject to conflicting cost pressures (Figure 2). Intensifying competition from expanding, lower-cost chemical industries in other parts of world is exerting a strong downward pressure on the European industry's costs. Meanwhile, a series of other external forces are pushing supply chain costs upwards. To reconcile these cost pressures it will be necessary to make some radical changes to the management of chemical supply chains.



**Figure 2 : Conflicting Cost Pressures**



## 5. Supply Chain Improvements

In a series of brainstorming sessions the think-tank generated numerous ideas for supply chain improvement. Most of them emerged from direct experience of managing operations in the chemical industry. Others were stimulated by presentations on supply chain practices in other industrial sectors or the management of chemical logistics in other parts of the world. Break-out groups examined the costs, benefits and practicalities of implementing the various measures. This resulted in some proposals being rejected as too costly, impractical, counter-productive, unlikely to command much support in the industry or likely to infringe competition law. Ideas surviving this scrutiny were worked up into the following set of proposals:

### 5.1 | Company-specific Actions

#### Rationalise the range of commodity products

In some sectors of the chemical market, companies have tried to gain a marketing advantage by diversifying their product ranges, marginally differentiating products that are basically standard commodities. This may generate a small amount of additional sales, but at a high price in terms of supply chain inefficiency. The larger the number of stock-keeping units (SKUs), the higher tends to be inventory level and lower the efficiency of warehousing and transport operations. There is a need for chemical companies to review their product portfolios and assess the potential savings that could be made in production and supply chain costs from standardising on fewer SKUs. Individual companies may be reluctant to act unilaterally and risk suffering a sales penalty. The rationalisation of product ranges across the industry as a whole could, however, yield valuable efficiency gains and improve the overall competitiveness of the European chemical sector within the global market.



## Improve the degree of functional co-ordination

In the chemical industry, like many others, 'silo' structures still remain. There is still a lack of inter-functional co-ordination, and business strategy is usually dominated by production and sales objectives. Often insufficient attention is given to supply chain issues in the formulation of strategy and, as a result, opportunities for improving supply chain efficiency are missed. This is evident in the case of new product development. There are also many other ways, however, in which closer co-ordination between logistics and other functions can enhance overall business performance.

## More rational use of transport modes

As discussed earlier, road is overwhelmingly the dominant mode of transport for chemical products. This heavy dependence on road will become more of a liability as traffic congestion increases and fuller application of the 'polluter pays principle' by governments increases the tax burden on road freight operations. Chemical companies need to reassess their modal options and explore the opportunities for sending more product by rail or water.

The increase in the proportion of cross-border chemical sales in the EU and lengthening of chemical hauls should have helped rail to capture a greater share of chemical transport. Rail, after all, has a comparative advantage in long distance movement. However, its modal share has declined in recent years. In 2001, it handled only 6% of chemical traffic (expressed in tonnes-lifted) within national boundaries and 13% of cross-border tonnage (in both cases excluding pipelines and short-sea shipping) (Table 2)<sup>(18)</sup>. By comparison, rail carries approximately 19% of chemical tonnes-lifted in the United States<sup>(19)</sup>.

A combination of inflexibility, limited network access, poor service quality and, to a lesser extent, cost have in the past deterred chemical companies from choosing the rail and water-based modes<sup>(20)</sup>. The relative competitiveness of these modes has, nevertheless, improved in recent years and this is likely to continue as the European rail freight market is gradually liberalised and national governments and the EU invest in inter-modal projects. The European chemical industry must be ready to respond to changes in the relative competitiveness of the different transport modes.

## More effectively exploit advances in ICT / telematics

ICT is the main driver of supply chain improvement across industry. Chemical companies, like their counterparts in other sectors, have invested heavily in new ICT systems, particularly Enterprise Resource Planning (ERP) software. Some companies, however, are not fully exploiting the potential that these systems offer for managing the supply chain more efficiently. To gain maximum competitive leverage, they generally have to re-engineer supply chain processes. The resulting benefits usually justify the extra cost and effort that this entails.

At an industry level, the creation of online platforms (or 'e-hubs') is gradually transforming the trading of chemical products. Companies will need to ensure that online trading is conducted in a way that maintains or improves overall supply chain efficiency.

Chemical companies also need to maximise the benefit they derive from advances in telematics and telemetry. Recent surveys have shown that the use of vehicle tracking can significantly cut operating costs and improve service quality<sup>(21)</sup>.

## Continue to upgrade safety standards

The safety standards attained in the movement and storage of chemical products across Europe are among the highest in the world. Despite the pressures on companies to cut supply chain costs, these standards cannot be relaxed. On the contrary, companies should be continually striving to upgrade these standards. This will not only ensure compliance with increasingly stringent regulations, but also help to improve the industry's public image.

# 5.2 | Vertical Supply Chain

## Increase the proportion of product distributed in bulk

By comparison with their counterparts in North America, European chemical producers distribute a relatively small proportion of their output in bulk loads. According to Philip Townsend Associates, only 4-5% of commodity plastics are distributed in packaged form in North America as opposed to 30-35% in Europe<sup>(22)</sup>. Much packaging / customisation of the product occurs at the point of production. Transport costs per tonne-km are thereafter much higher than they would be if the product were despatched in bulk. By avoiding the need for packaging or delaying it until a later stage in the supply chain, chemical companies would effectively be applying the 'postponement principle', a principle that has been widely adopted in other sectors to very good effect<sup>(23)</sup>. This would cut the number of SKUs in the upper reaches of the supply chain, permitting a reduction in inventory levels and yielding significant savings in transport and handling costs.

## **Greater differentiation of the standard of distribution service provided to customer groups**

Many chemical companies tend to offer a 'one-size-fits-all' distribution service. As a consequence some customers are probably receiving a poorer service than they would like, while others are getting a better service than they require. Furthermore, the standard of service provided to particular customers often bears little relation to the prices charged. Varying the standard of logistical service in line with customer requirements and relating charges more closely to the 'cost-to-serve' would be more difficult to manage, but would offer net benefits in improved efficiency, higher profits and greater customer loyalty.

## **Provide a vendor managed inventory service to customers**

Vendor managed inventory (VMI) is now a well-established practice in many other industrial sectors, where it has permitted more effective supply chain management for the mutual benefit of suppliers and customers. It relieves customers of the need to place orders in the conventional manner and puts the onus on suppliers to replenish customers' supplies within agreed limits. This gives the producer both visibility and control of the end-to-end supply chain, allowing it to manage inventory and transport capacity more efficiently<sup>(24)</sup>. From the customer's perspective, the main disadvantage of VMI is that it locks them into a single-sourcing arrangement with a particular supplier. Experience in other sectors, however, suggests that the risk associated with single sourcing can be more than outweighed by the cost and service benefits of VMI. Also, 'vendor hubbing', a service provided by some logistics service providers, allows a customer to combine VMI with multiple sourcing from several suppliers.

## **Move to alternative payment terms**

Most chemical companies invoice at the end of each month, giving their customers an incentive to order at the start of the month and thereby obtain a longer period of interest-free credit. Sales levels also tend to rise at the end of a month as staff endeavour to meet monthly sales targets. These practices induce wide fluctuations in the volume of flow in the chemical supply chain, making it difficult for chemical companies, and their logistics service providers, to manage their warehousing and vehicle capacity efficiently. By abandoning the monthly payment cycle and moving to a system of 'rolling credit', which computerised financial accounting systems now facilitate, companies could improve the average utilisation of logistics assets. This would require a fundamental change in corporate culture and a relaxation of long-established traditions in sales and finance departments both in the chemical industry and across its customer base.

## Clustering of downstream processing around chemical plants and freight terminals.

Unlike the other measures proposed in this section, which would involve a change to business processes and could be implemented in the medium term, this proposal would entail the relocation of production capacity – a development only likely to happen over the longer term. The current distribution of downstream chemical processing capacity is a legacy from an earlier era when national chemical markets were more self-contained and the optimum size of plants was much smaller than it is today. The overall efficiency of the European chemical industry could be significantly enhanced if this capacity were consolidated into larger units and these units clustered either around the main crackers or major logistical hubs at which chemical supply chains converge.

## 5.3 | Horizontal Collaboration

### Develop swap arrangements

In the petroleum sector, oil companies freely enter into swap arrangements supplying their branded products from each other's refineries. This substantially reduces the amount of petrol moved around Europe, saving on distribution costs, compressing delivery times and benefiting the environment. Although most of the major oil companies have a chemicals division, there has been more limited development of swapping in this sector. It tends only to happen during periods of crisis, when companies assist each other in the event of production or supply chain breakdowns. Chemical companies should now be actively exploring the costs and benefits of swapping capacity on a more systematic basis.

One of the main constraints is clearly the diversity of companies' current product ranges. Swapping would require much greater standardisation of product specifications and grades. It would, therefore, be contingent on the product rationalisation discussed in section 5.1. This would require chemical companies to relax their current commitment to product differentiation as a key element of business strategy. Given the magnitude of the potential benefits to the European chemical industry as a whole this should now be given serious consideration. This should comply within EU competition rules and indeed prove beneficial in public policy terms, as government agencies are keen to find ways of reducing freight traffic levels across Europe.



## Pooling of logistics resources

At present, different companies have their own pools of containers and handling equipment. These must be separately repositioned and maintained. Consolidating this equipment into a single industry-wide pool would substantially improve its average utilisation. The total pool could then be downsized, cutting the level of capital investment, and the operating cost per unit load reduced. This will require greater standardisation of equipment and the development of a new organisational structure. It is not clear at this stage who would manage such a pool. It could be handled by a joint venture company established by a group of chemical producers and / or logistics service providers.

## Improve the backloading of vehicles and containers

There is scope for improving the backloading of vehicles that carry chemicals on their outbound leg. More of this backloading could be cross-sectoral, generating return loads of non-chemical products. While the risk of cross-contamination clearly constrains the types of product that can be collected, this is not as serious a constraint as often claimed. Even within the chemical industry, greater effort could be made to achieve more balanced loading of vehicles. For example, more explicit reference could be made to backloading opportunities in trade negotiations with customers. Much of the responsibility for backloading will, nevertheless, remain with carriers.

## Raise the level of supply chain skills in the chemical industry

Companies in many sectors are currently complaining about the difficulty of recruiting well-qualified logistics and supply chain specialists. Chemical companies are no exception. Some national governments are sponsoring initiatives to upgrade logistics skills. In the UK, for example, the newly created sector skills body for logistics (called 'Skills for Logistics') has identified chemicals as one of nine supply chains that they have targeted for support. There is more that chemical companies could do collectively across Europe to promote training courses in logistics and supply chain management and endorse professional standards in this field.

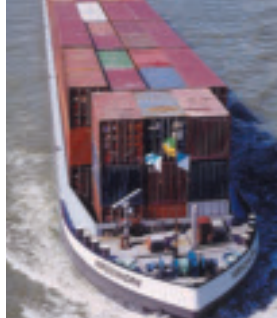
## 5.4 | Outsourcing of Logistical Activities

### Develop stronger relationships with logistics service providers

The section of the third-party logistics (3PL) market serving the chemical industry is highly fragmented and largely composed of small- to medium-sized family businesses. While most of these companies deliver a reliable service at reasonable cost, they often lack the resources and dynamism to provide truly innovative supply chain solutions. The chemical companies are themselves partly to blame by treating logistics as a basic commodity service to be purchased at minimum cost. As these companies currently outsource a large proportion of their logistics, implementation of the supply chain improvement measures described in this report will require the full support of logistics service providers.

Stronger relationships need to be established with logistics service providers. It may often be beneficial to establish joint initiatives with these LSPs, involving them more directly in the development of new supply chain strategies for the industry. It should be done in compliance with EU competition rules. Chemical companies should also be prepared to reward LSPs for a higher level of support to encourage them to become more proactive. Logistics service providers have traditionally offered services and rates which allow them to maximise the utilisation of their terminal and vehicle assets. As this tends to 'fossilise' the existing system of distribution, they need to be given an incentive to redesign their systems as part of an overall programme of supply chain improvement in the chemical industry.

It was anticipated that within a few years of the formation of the Single European Market in 1993 a new generation of pan-European carriers would emerge. Now, more than a decade later, some logistics companies do offer extensive geographical coverage across Europe, but not to the chemical industry. No single logistics provider has the capability to meet all the logistical requirements of any of the major European chemical companies. While many of these companies would not want to entrust their entire logistics operation to a sole provider, they could probably manage their supply chains more effectively if they could rely on a smaller number of carriers with more geographically extensive networks.



## **Make greater use of Lead Logistics Providers / 4th party logistics providers**

By pooling the purchase of logistical services, these organisations can help chemical companies reduce supply chain costs and manage their service providers more effectively<sup>(25)</sup>. Some are also improving their 'value proposition' by providing strategic advice on the design of logistical systems, supplementing the skill base and adding an external perspective.

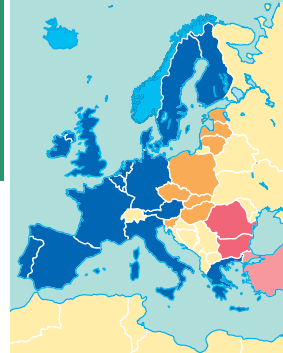
## **Overhaul the measurement of LSP performance**

The evaluation systems used by chemical companies to assess the quality of service they receive from logistics service providers are sometimes antiquated and poorly aligned with their logistics and supply chain strategies. As these systems condition the carriers to behave in particular ways, it is important that they send the right signals and promote best practice. The European Chemical Transport Association (ECTA) and Cefic have developed guidelines for standardised performance measurement for transport companies in the chemical sector. These need to be more widely adopted and given a broader supply chain perspective.

## **Extended use and optimization of existing container terminal infrastructure**

The efficiency of the chemical supply chain partly depends on the availability of a European terminal and hub infrastructure capable of meeting the demand for intermodal services. Over the past decade many chemical companies, working with logistics service providers and often taking advantage of EU grants, have developed 'over-the-fence' container terminals, handling mainly outbound flows of products from their major production plants. Some of these chemical terminals could also be considered to be part of a strategic European network of public inter-modal hubs and, therefore, also be used for inbound flows of raw material and for regional redistribution of non-chemical products. This would improve the utilisation of terminal assets, create a more balanced flow of equipment and facilitate the repositioning of empty containers.

In a cross-sectoral context, there is an important inter-relationship between the utilization of terminal capacity and several of the other proposed actions, including the relocation of downstream manufacturing, the wider adoption of VMI and the pooling of logistics assets. These measures could be mutually reinforcing.



## 6. Role of the EU and National Governments

As discussed earlier, it is for the chemical industry itself to develop more efficient ways of managing its supply chain. However, public policy-makers also have a strong interest in the organisation of supply chains as they seek to reduce the cost to society in terms of the pollution, land-use, accidents and congestion associated with transport. The chemical industry could benefit from the following series of initiatives:

### Opening of freight markets

Open freight transport markets are an essential condition for the optimum allocation of freight traffic between modes. The transfer of chemical traffic from road to rail, which was strongly advocated in section 5.1, will be more likely to occur if the European rail freight sector becomes more competitive. At present, most of the state-owned monopolies which provide rail freight services are not sufficiently market-responsive and this partly explains why such a small proportion of chemicals moves by rail in Europe. Another reason is the absence of an integrated network of rail freight services at a European scale. Europe has still a patchwork of national rail administrations that do not adequately co-ordinate their operations or standardise their equipment. For the full benefits of liberalisation to be realised, much greater international co-ordination and interoperability will be required. As large transport users, some chemical companies have championed new rail services. They should continue to clearly voice their requirements and put pressure on rail operators to provide customer-oriented services. However, attention should also be paid to logistics practices which foster greater use of rail, short-sea shipping and inland waterways. Stringent enforcement of existing European legislation is also essential for the success of rail freight in Europe.

There is considerable potential for increasing the proportion of chemical traffic carried by short-sea shipping, and it is essential that both shipping and port services provide customer-oriented solutions. Port and shipping operators, however, will still require a commitment by chemical companies to make regular use of these services before providing the necessary capacity and facilities.



## Risk-funding for new inter-modal services

A modal shift from road to other, more environmentally friendly modes always entails some risk, as inter-modal services are more complex to set up than road transport, and it is not easy to achieve viable load factors. Government-funded programmes which share some of the risk in setting up new inter-modal services are therefore welcome. At an EU level, the Marco Polo programme aims to promote greater use of inter-modal services, though has a rather modest budget of only 100 million Euro over the period 2003-2006. The second phase of this programme (Marco Polo II) will have a more generous budget of 740 million Euro over the period 2007-2013 though it will cover a much larger geographical area. Marco Polo II has the ambitious target of transferring all the forecast growth in international road freight traffic over this period onto rail or water-based modes. This will require a significant increase in the proportion of international chemical traffic shifting to inter-modal services. It is also noteworthy that Marco Polo II, as proposed by the Commission, encourages better use of existing transport resources through its 'transport avoidance' actions. These are designed to reduce the transport intensity of production operation and distribution operations. The Marco Polo programme is open to all commercial undertakings. This creates opportunities for user-driven projects which identify and satisfy the needs of the chemical industry. Industry has, therefore, an interest in supporting the existence and expansion of such programmes.

## Harmonisation and standardisation

As stated above, harmonisation and standardisation are essential for a more efficient supply chain. Transport markets suffer from fragmentation and lack of standardisation. The efforts of the European Union to support more widespread standardisation, such as the introduction of European Inter-modal Loading Units and the creation of a framework for River Information Systems, are very welcome. Over the next few years there will be a pressing need for greater standardisation of telematics systems and the electronic tolling systems that countries will be introducing to tax trucks for their use of road infrastructure.

## Financial support for transport infrastructure and terminal development

While it is recognised that governments cannot build their way out of the congestion problem, more investment in key corridors and terminals is essential to relieve bottlenecks. The level of investment in transport infrastructure fell from an average of 1.5% of European GDP in the 1980s to 1% in the 1990s<sup>(26)</sup>. This funding trend needs to be reversed. The recent revision of the Trans-European Network Guidelines identifies a number of large-scale infrastructure

projects. Some of these projects, if implemented, will facilitate the movement of chemicals and help to raise supply chain efficiency. While infrastructure planning and construction is, to a large degree, the responsibility of local and national authorities, there should be greater user-involvement in the development of transport infrastructure. For example, the “motorways of the sea” initiative, under the revised guidelines, specifies that all partners in the supply chain need to be committed to such projects, linking logistics with infrastructure. The chemical industry as a large transport user should thus seize this opportunity to get involved. When multi-modal and multi-sector freight terminals are being planned, built and maintained, user-involvement is necessary to ensure that their use and operation is optimised.

Pipeline development should also receive more attention in infrastructure planning and strategies. Governments often argue that as pipeline networks are industry-specific they should be funded by private capital. While the development of pipelines should remain primarily the responsibility of the industry, governments could provide some financial support in recognition of their wider environmental and social benefits. A much larger proportion of chemicals are moved through pipelines in the US than in Europe and there is clearly scope for expanding their modal share in Europe. This could be achieved by constructing new pipelines to link disconnected clusters of chemical plants and terminals into an integrated supply network.



## 7. Conclusions

The European chemical industry has tended to lag rather than lead the development and implementation of new logistical practices and technologies. This can be attributed to several factors, including :

- A preoccupation on new product development, production efficiencies and sales strategies and under-estimation of the potential benefits of supply chain improvement
- Too narrow a focus on transport and failure to consider wider supply chain implications
- Conservative attitude of supply chain management in this industry, much of which has lacked exposure to logistical practices and trends in other sectors

Over the next decade, chemical companies will have to overhaul their supply chains to meet a series of external challenges. In particular, competition from the emerging chemical industries of the Middle East, Far East and Eastern Europe, tightening environmental and security controls and mounting congestion on European road infrastructure will force them to reappraise their current methods of distribution. Some of the required changes will involve nothing short of a change in the corporate mindset. The adoption of swap arrangements, switch from packaged to bulk distribution and transfer of chemical traffic from road to rail and water, for example, will represent a dramatic change in the way chemicals are produced and distributed in Europe.

This report has identified a long list of supply chain improvement measures that chemical companies should now be seriously considering. Most of them can be grouped under six general headings :

**Collaboration:** horizontally between producers, vertically across the supply chain and between producers and logistics service providers.

**Segmentation:** greater differentiation of customers in terms of their logistical service requirements and closer alignment of pricing with the cost-to-serve.

**Coordination:** of production, sales, marketing and logistics functions, further dismantling the 'silo' structures and according supply chain management the attention and resources traditionally reserved for R&D, production and sales.

**System optimisation:** even if the present distribution of production capacity is retained, significant rationalisation of supply chains can be achieved by product swaps, a redefinition of the role of terminals and the transfer of traffic between transport modes.

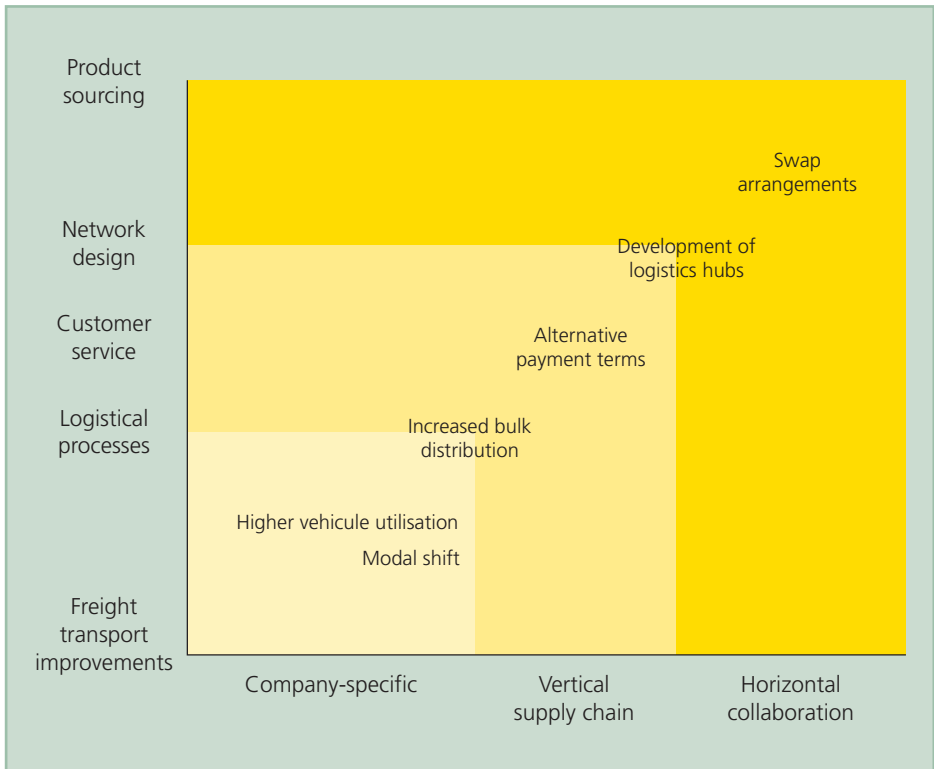
**Standardisation:** of commodity products, handling equipment and vehicles. Enhanced inter-operability will permit greater pooling of equipment and improved asset utilisation.

**Liberalisation:** of the European rail freight, port and shipping markets will create new logistical opportunities which chemical companies must be ready to seize.

Many of the measures that have been identified are mutually reinforcing. If implemented as part of a well-conceived package of supply chain improvements, their combined effect will be greater than the sum of their individual impacts.

The greatest efficiency gains will accrue from fundamental changes to the industry-wide supply network, requiring horizontal collaboration between major producers in the sector (Figure 3). These changes can reduce the overall transport intensity of the European chemical industry, yielding both major economic and environmental benefits. They can be usefully supplemented, however, by improvements to the replenishment cycle achieved through better collaboration between producers, distributors and customers in the vertical channel and by logistical productivity gains achieved by individual companies.

In the field of supply chain management, the European chemical industry has important lessons to learn from other industrial sectors and its counterpart in the United States. By adopting current best practice in logistics and supply chain management, the industry will be in a much stronger position to compete in the global market and meet the host of external threats likely to arise over the next decade.



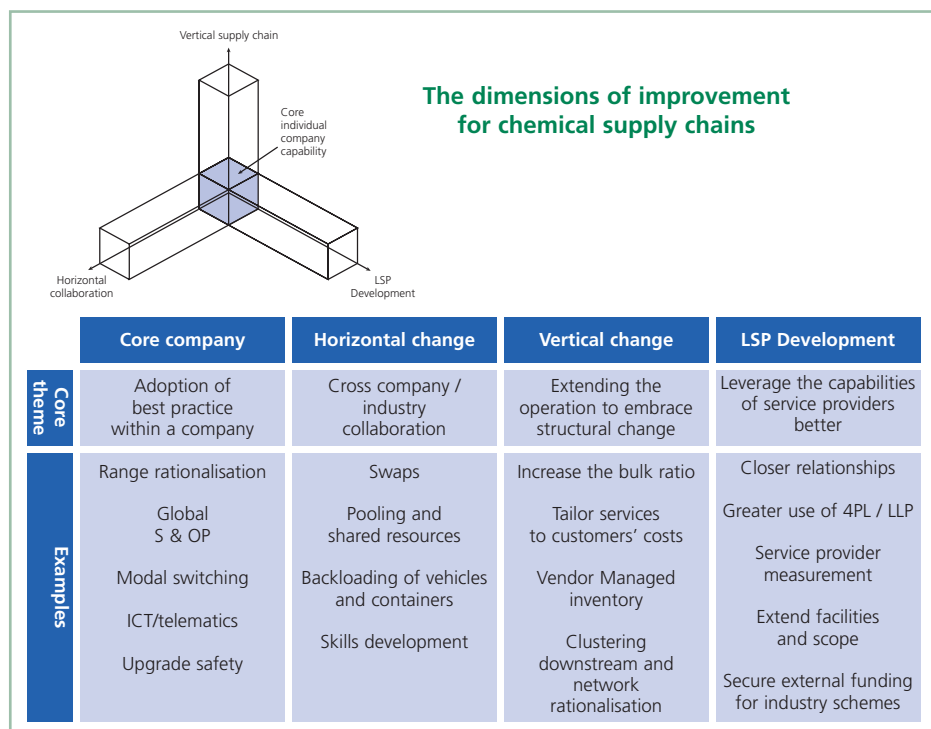
**Figure 3: Levels of Supply Chain Improvement**



## 8. Next Steps

This report presents a clear statement of the directions that the industry can take to address the threats that have been identified and enhance its competitiveness in global markets. The European chemical industry is facing an impending crisis and that this will require major changes to the management of the supply chain.

As discussed earlier, there are four dimensions on which companies can act to mitigate the threats that have been identified. These range from improvements within the company, through vertical and horizontal collaboration and to the connections with and capabilities of logistics service providers (Figure 4).



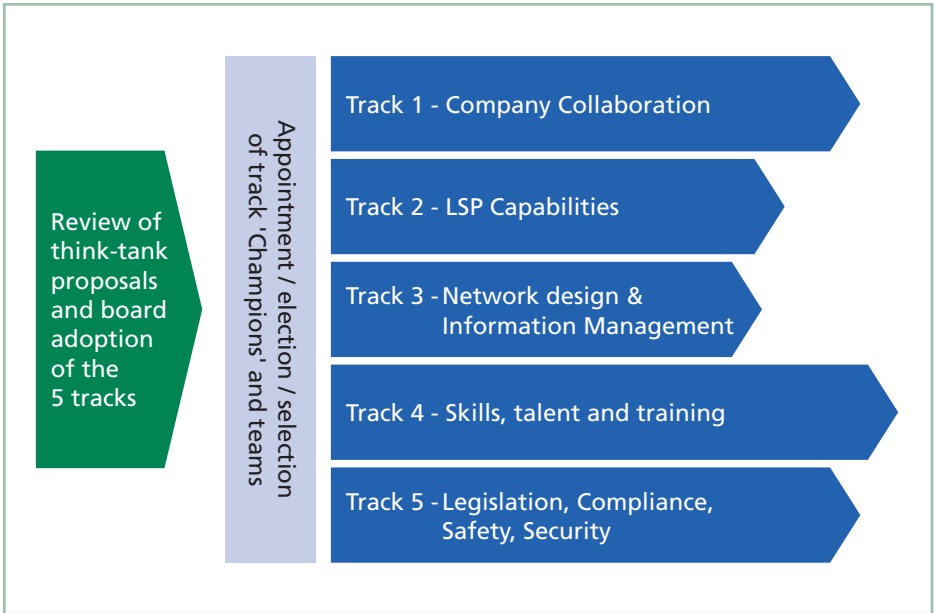
**Figure 4 : Dimensions of Improvement**

Collectively these initiatives represent a substantial pool of potential improvements. The benefit profile will vary from company to company depending on their specific combination of products, markets, sources and capabilities. Partly for this reason, and partly because time limitations, it has not been possible to model the impact of these measures or estimate the resulting economic and environmental benefits. These benefits are, nevertheless, likely to be large and will require industry-wide collaboration alongside market competition and individual company initiatives. This collaboration will be essential for several reasons:

- 1 Investment in shared capacity, of vehicles, terminals and ICT systems, may exceed the financial scope of service providers and individual producers.
- 2 Industry-wide consultation, and possibly advocacy, will be required to ensure that the regulatory environment is conducive to the safe and efficient operation of chemical supply chains.
- 3 The nurturing of logistics and supply chain skills in the European chemical sector will benefit from industry-wide rather than company-specific initiatives.
- 4 The willingness and ability of the logistics service sector to innovate will need to be challenged and developed to meet the chemical industry's strategic imperatives.
- 5 Cross-sectoral collaboration will be required to achieve higher utilisation of freight terminals and equipment.

Together these points constitute a significant agenda for change.

This report should therefore be regarded as a **call for action** by the industry to mobilise its collective resources to meet these challenges. To assist this process, a roadmap has been prepared comprising five tracks, each of which will require a champion and support team (Figure 5).



*Figure 5 : Road-Map for Action*



We recommend a sequence of steps to initiate these tracks:

**Step 1** – This report needs to secure a broad level of industry acceptance. Logistics managers and the directors of service providers (of ICT as well as logistics services) should circulate the report widely in their organisations and seek active support for the tracks as future courses of action. EPCA and Cefic will collate feedback and expressions of interest from individuals and organisations. It is critically important that the recommendations in this report are drawn to the attention of senior management. This should not only emphasise the strategic role of logistics and supply chain management but also secure wider sponsorship of the five tracks across the business.

**Step 2** - Track chairmen and teams will be required to support the tracks. There are likely to be people and companies who will want to assume a leadership role in driving the work forward. It will be desirable for each track team to have broad industry and functional representation. For example, the ‘company collaboration’ track will require a team that combines marketing and sales, production, inventory planning and ICT skills. Government liaison will also be a critical capability for this track to ensure that any competition issues arising from swap arrangements are adequately addressed.

The team dealing with the development of LSPs will probably be led by a senior executive from an LSP and will include major shippers, terminal operators, planning and regulatory specialists.

**Step 3** – The Track teams now begin work. Their mission will be to prepare and promote detailed plans for their specific field. At the outset, they will define goals, working methods and deliverables. They will then need to determine the resources required to fund the analytical and development work. Decisions will then have to be taken on how best to fund this activity. Track teams will need to consider if this can be managed through academic, in-company or consulting routes (or some combination) and whether funding can be obtained from the EU or national governments.

Without prejudice to the work of the Track teams, an outline framework has been prepared with possible deliverables listed for each of the tracks (Figure 6).

It is recommended that EPCA and Cefic maintain an overview of the work as it progresses and provide a network through which wider industry consultation and dissemination can be achieved.

## Examples of Expected Track Work Content and Deliverables

### Track 1 - Company Collaboration

- Business case and demography for swaps.
- Industry swap process & systems design.
- Customer stock and service, collaborative process design.
- Define new distributor service models.
- Define new credit models to smooth ordering.

### Track 2 - LSP Capabilities

- Develop innovative economic models for 3PL multi-modal and terminal services.
- Develop business case for shared equipment use.
- Create handbook for industry use of 3PL and 4PL services.
- Take input from Track 3 on optimal network.

### Track 3 - Network design & Information Management

- Modeling of industry demographics to determine ideal location for shared service hubs.
- Mapping and design of information management requirements to enable higher bulk % and swaps.
- Capacity planning and modeling for new flows.

### Track 4 - Skills, talent and training

- Mapping skills requirements to industry talent pool.
- Design industry wide training and development programme in context of plans emerging in other tracks.
- Source authorised providers.

### Track 5 - Legislation, Compliance, Safety, Security

- Consider impacts of current and future regulatory controls on the competitiveness of the industry.
- Develop options for compliance and communication programme.

**Figure 6 : Track Work Content and Deliverables Examples.**

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# Annex 1 : The Think Tank Initiative

A 'think-tank' was set up comprising senior supply chain managers in large chemical companies and other logistics specialists. The members of the think tank were as follows:

- Mr Hans-Jörg Bertschi, Bertschi AG (meetings 2-3)
- Mr Alan Braithwaite, LCP Consulting
- Mr Phil Browitt, Agility
- Mrs Cathy Demeestere, EPCA
- Mr Jack Eggels, Shell Chemicals Europe
- Mr Paul Evertse, ExxonMobil Petroleum & Chemical
- Dr Thomas Franck, BASF
- Mr Paul Gooch, Dow Chemicals (meetings 2-5)
- Mr Frank Otten, DSM
- Mr Nicholas Pina, Lyondell (meetings 2-5)
- Mr Charles Proctor, BP Chemicals
- Mr Ronald van Klaveren, Lyondell (1st meeting)
- Mr Jos Verlinden, Cefic
- Mr Wim Vrijland, Dow Chemical (1st meeting)

Professor Alan McKinnon of the Logistics Research Centre at Heriot-Watt University acted as facilitator.

The group had five full-day meetings over a period of nine months.

Experts in various aspects of transport, logistics, industrial development, government policy and environmental management gave presentations to the group.

- Mr David Bohmbach, Philip Townsend Associates
- Prof Keith Chapman, University of Aberdeen
- Dr Werner Pratorius, BASF
- Mr Karel van Miert, former EC Transport Commissioner
- Mr René van Sloten, Cefic
- Dr Stefan Tostmann, European Commission
- Prof John Whitelegg, Swedish Environmental Institute / Ecologica

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