Kompetenzgruppe
Chemielogistik

# Leveraging Supply Chain

## for strategic advantage in the Chemical Industry

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This study was carried out by Kompetenzgruppe Chemielogistik

Kompetenzgruppe
Chemielogistik


Technology
Arts Sciences
TH Köln


CMC
Consulting for Managers in Chemical Industries

# CONTENT

CHAPTER 1

# IMPACT OF LOGISTICS

# 1 Unrealized Strategic Impact of Logistics on Competitive Advantage

## The Chemical Industry is going through a period of significant change, driven by many factors:

- access to feedstock,
- falling oil price and consequently falling prices for commodities,
- globalization of supplier and customer base,
- rapid commoditization of products, and
- increasingly complex customer requirements.

The ability to respond to the challenges posed by this changing environment is critical to long term success. For many companies, an agile and sustainable logistics capability is a vital factor - yet logistics has tended to be viewed as a "necessary evil", and as such has not been established as a boardroom topic.

However, recent experiences have shown that Chemical Logistics is an excellent source for the differentiation of the chemical product portfolios by optimizing the product value, liquidity costs and by providing strategic hedging of mission-critical logistics assets and security risks. For example, a producer of chemical commodity is able to secure the constant supply of a very important raw material for their customer through logistic core competences with the help of logistic professionals and dedicated equipment.

Logistics only becomes a boardroom topic when major mistakes have been made and accidents have happened already. Then the drama starts – especially chemical companies have a special sensibility for negative publicity: Regardless whether the fault was in the responsibility of a service provider, the consequence for the effected chemical company will certainly be massive and the companies' image will be negatively affected and stigmatized in the future.

But, as mentioned above, when logistics processes are working in a satisfying manner, they are usually not a boardroom topic. Nevertheless, proactively aligning logistics to the special need of product sectors and customers is a strategic lever for competitive advantage. Chemical companies who cannot position their products well on the market by customer tailored logistics solutions and value-added services will experience decreasing market shares compared to those players which see logistics as an integral part of their board room strategy and product offering.

This paper shows the international importance of chemical logistics, and reveals five important topics which the board of a chemical company is highly recommended to address and provides the board with several ideas for solving their logistics challenges.

» Logistics and Supply Chain Management often is not at the top of the food chain as executive priority. «

**An D'Haenens**, Global Manager Compliance, Sustainability and Logistics Enablement, EMEA Sourcing and Logistics Leader, DuPont Coordination Center

CHAPTER 2

# MOTIVATION

# 2 Motivation, Objectives and Methodology of the Study

Inspired by the work of "Kompetenzgruppe Chemielogistik" in numerous consulting projects and dedicated research with decision-makers from the chemical industry and logistics service providers, the authors of the study came up with the idea to examine the importance of logistics for the boardrooms of the chemical company explicitly.

The hypothesis that logistical levers are underrepresented in the focus of the board members was specified in discussions with DHLs logistics experts, which represent the chemical industries' counterpart within the corporation.

DHL Global Forwarding, Chemicals Sector, decided to support the research of Kompetenzgruppe Chemielogistik by sponsoring a Whitepaper examining the said topic.

The central research question of the present whitepaper was specified: Which levers of supply chain management are of strategic relevance for the top management levels of the chemical industry?

## The methodological approach to answer this question is a combination of the following elements:

Existing experience and knowledge from **previous studies and projects conducted by the authors** were included in the study: Experience from prior studies in the field of chemical and logistics industries[1], numerous consulting projects connected to the current subject both with industry and logistics service providers[2], as well as applied research and numerous relevant students projects, especially bachelor and master theses. Not only the basic hypothesis and the research question was derived from that experience, but also the first draft for guideline and structure of the expert interviews then specified by desk research and practical pre-tests.

**Desk Research** to describe the worldwide market of chemical logistics and the quantification of important connections in the global flow of chemical goods. These should give an idea of the total volume of cost that is triggered by logistics and thus can be influenced by logistical decisions. The following elements are included in desk research:

- Secondary statistics
- Internal databases and operating figures on logistics markets within Fraunhofer SCS
- Industry associations (e.g. VCI, ECTA; Cefic, ICCA)
- Analysis of case studies, surveys and further publications on chemical industry and chemical logistics
- Verification and completion with a focus on global chemical logistics

To gather especially qualitative information **semi-structured interviews**[3] were conducted with experts and decision makers from relevant industry partners of DHL and Kompetenzgruppe Chemielogistik. With this well approved method trends and developments from the perspective of industry partners are systematically collected as well as findings from the previous methodological steps consolidated and discussed with professionals from industry and logistical service providing. An extensive and empirically reliable research would be beyond the scope of this project. The authors therefore do not claim that the sample is representative in all aspects. Through a "conscious choice"[4] interview partners were selected that were most interesting for the respective research question. This method allowed to cover the full range of international players, bigger as well as smaller companies. Furthermore different levels of the value added process of the chemical supply chain as well as various geographic areas were covered.

The involved interview experts were logistics and supply chain experts from global chemical industry[5].

CHAPTER 3

# RELEVANCE

# 3 Relevance of International Chemical Logistics Networks

The chemical industry is one of the most important economic sectors. Its products are used in all manufacturing industries. Worldwide chemical sales are valued at 3,534 billion in 2015[6], while international trade volumes amounted to more than 700 million tons.[7] The sheer variety of different requirements for load carriers, safety regulations and product handling causes special challenges for the efficient management of its supply chains. The current relevance and structural implications of this particular logistics environment are described in an overview below.

## 3.1 International Supply Chains of the Chemical Industry

By its very wide range of products, the integration of almost all modes of transport and the high international link of upstream and downstream value chain stages, the chemical industry shows a very broad variety of different supply chains. While raw materials are traditionally procured in the oil-exporting countries, further processing steps take place in the industrialized countries. Final products are sold globally in most cases, to use both the advantages of vertical integration (including insourcing/ outsourcing degree of logistic services), as well as the international sales opportunities.

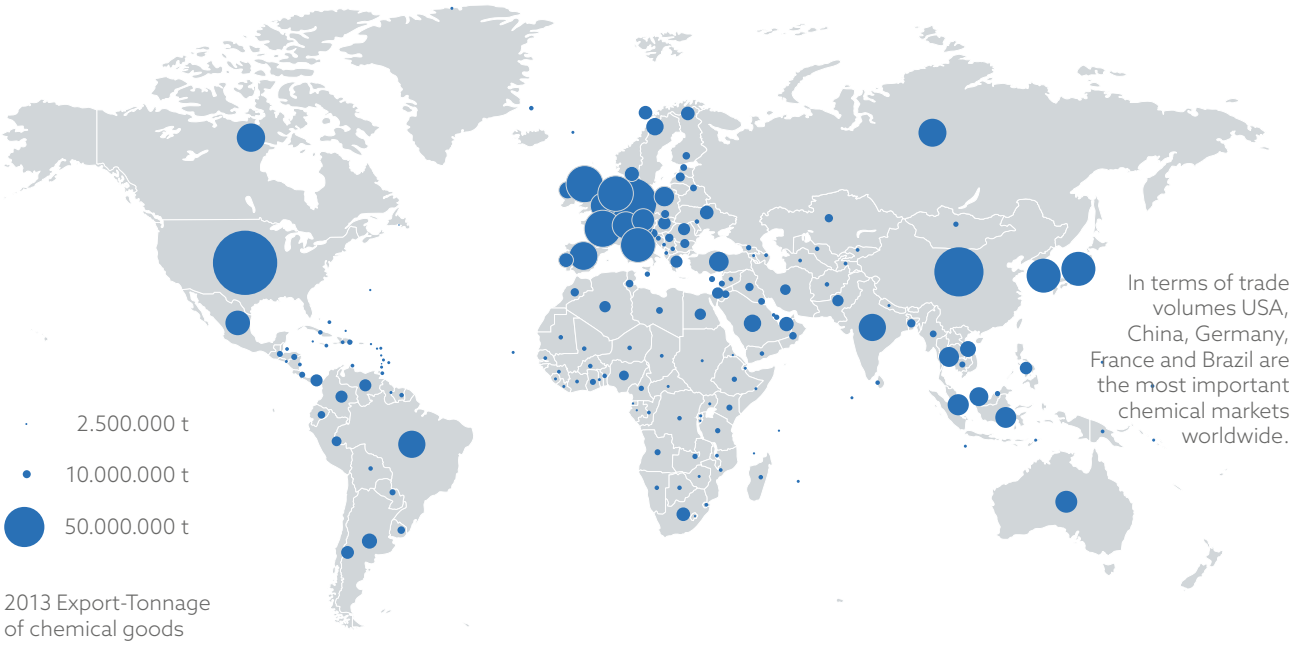



Figure 1: Geographic breakdown of international chemical export volumes

Depending on its production capacities on the different steps of the value chain, each market is heavily connected to its preceding and subsequent supplier and customer countries. The map in Figure 1 shows the volumes of chemical goods exported by each chemical producing country. Thus, the biggest export clusters can be allocated in Europe, North America and Asia.

To specify the supply chain solutions to fulfill the needs of the customers, the goods flows need to be analyzed in more detail. The next illustration shows the Top-10 of the most important trade lanes on a continental level as well as their subcategories of the transported goods (Figure 2). Whereas Latin America turns out to be a big customer of fertilizers, most of the other trade lane based pie charts show a much more differentiated mix of goods.

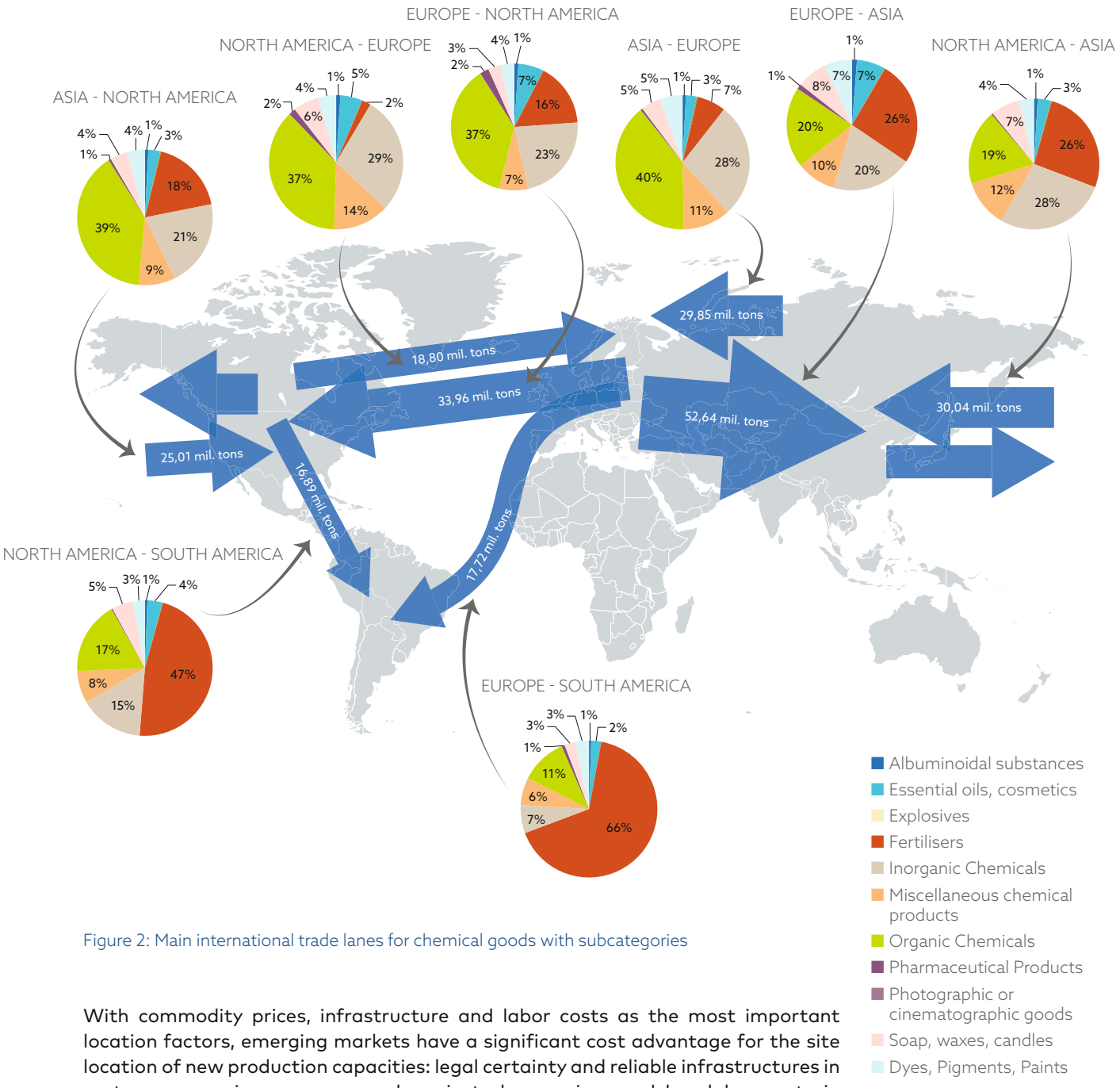
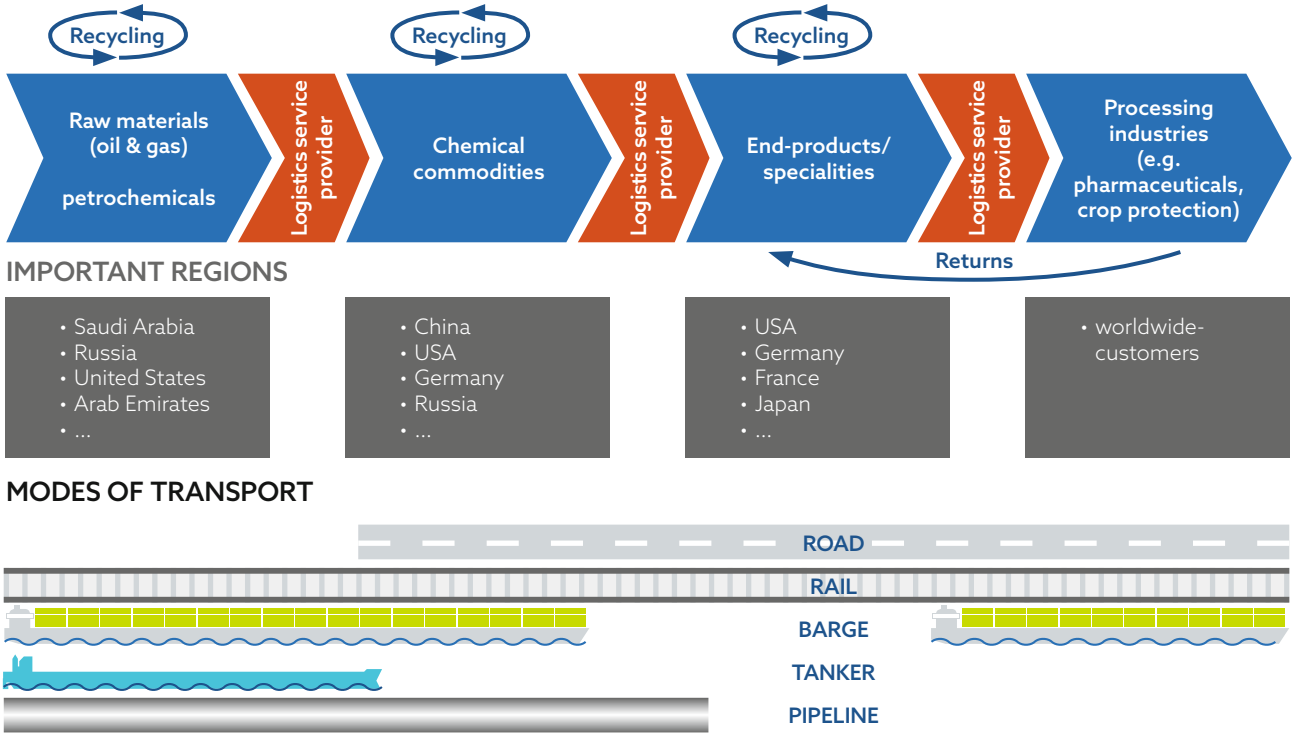



Figure 2: Main international trade lanes for chemical goods with subcategories

With commodity prices, infrastructure and labor costs as the most important location factors, emerging markets have a significant cost advantage for the site location of new production capacities: legal certainty and reliable infrastructures in mature economies are measured against cheap prices and low labor costs in developing countries. This well-established situation of the last two decades is currently shifting because of shale-gas extraction in the USA, which has provided the US Chemical Industry with a significant stimulus, and has led to significant investment in new and expanded manufacturing capacity. On the other hand, crude oil as one of the most important feedstocks has seen a drastic decline in prices since mid-2014 which threatens the newly enlarged fracking capacities.

All the medium- to long-term forecasts, however, agree on two aspects: Production volumes in industrialized countries will grow at a slower rate than those in emerging markets and the already significant global role of China for chemical products will keep expanding overproportionally.

This has strong implications for the supply chains of the chemical industry: the complex requirements regarding the handling of hazardous goods are additionally subjected to a dynamic market environment because of supply and demand fluctuations, changing raw material prices and shifting production and transport capacities.




Manufacturing companies have to deal with numerous product categories, markets and production facilities. Acting as a link between the single steps of their value chain, logistics service providers are affected by this high complexity of chemical supply chains, too.

Figure 3: Generic supply chain in the chemical industry

The generic value chain illustrated in Figure 3 is just a rough approximation of a much more complex supply chain.

At the beginning of this ideal-typical chain very large volumes of raw materials and commodities are transported as bulk - heavy transport carriers such as pipelines, tankers and barges are needed. At the end of the chemical value chain, shipment volumes decrease, while the share of low-volume road transports rises.

Actors in the field of chemical logistics are thus faced with a very challenging market environment: for both suppliers and shippers, it is necessary to agree on very different levels of requirements for the handling of storage and transport processes.

## Key results

Next to their home market all the interview partners state South East Asia, China and India as most important in presence or emerging in the future. The "traditional" markets North America and Europe are of constant importance.

## 3.2 Macro-economic Importance of International Chemical Logistics

According to Cefic, worldwide chemical sales were valued at 3,534 billion in 2015.[6]

Given the global scope of the increasingly complex supply chains, the logistics cost volume associated with them is not to be underestimated. However, the actual logistics costs vary greatly according to the type of goods, used transport modes and source regions. Besides the size of the international trade volumes, the specific value per ton or value density is a good indicator for the logistics costs behind a group of goods: it shows the statistical average value of one ton of a specific good. The lower this value density, the higher the associated cost share regarding transport, storage and handling of the underlying goods. This contrasts with the end customer focused products with relatively high value density. The table below shows the value density for 10 subcategories of chemical products that are included in the statistics analyzed.

| HS-Code | Description | Trade value 2013 in Billion USD | Million Tons traded 2013 | Value density in$/ton | Value density category |
|---|---|---|---|---|---|
| 28 | inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes | 104,3 | 157,5 | 662 | low |
| 29 | organic chemicals | 422,6 | 175,2 | 2.412 | above average |
| 31 | fertilisers | 56,9 | 159,3 | 357 | very low |
| 32 | tanning or dyeing extracts; tannins and their derivatives; dyes,pigments and other colouring matter; paints and varnishes; putty and other mastics; inks | 78,8 | 42,6 | 1.848 | average |
| 33 | essential oils and resinoids; perfumery, cosmetic or toilet preparations | 107,9 | 35,1 | 3.073 | high |
| 34 | soap, organic surface - active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, 'dental waxes' and dental preparations with a basis of plaster | 56,0 | 54,7 | 1.024 | low |
| 35 | albuminoidal substances; modified starches; glues; enzymes | 27,3 | 7,9 | 3.464 | high |
| 36 | explosives; pyrotechnic products; matches; pyrophoric alloys;certain combustible preparations | 4,3 | 1,0 | 4.152 | high |
| 37 | photographic or cinematographic goods | 16,8 | 0,9 | 18.614 | very high |
| 38 | miscellaneous chemical products | 180,6 | 71,3 | 2.532 | above average |
| | **sum / general** | **1.055,6** | **705,6** | **1.496** | **average** |

Figure 4: Value densities of chemical products[8]

The results show a diverse picture: while inorganic chemicals and fertilizers show a very low value density and are mainly transported in bulk loads, organic chemicals amount to the highest trade volumes with an also relatively high value density. In general, more valuable products need more sophisticated transports and value added services. Also, more valuable goods are usually transported in smaller trading units.

The actual analysis of case studies of the largest chemical suppliers and the results of the conducted expert interviews show a very broad range of 3 - 12% of the logistics cost share of the total sales revenues, while up to 20% can occur in extreme cases.

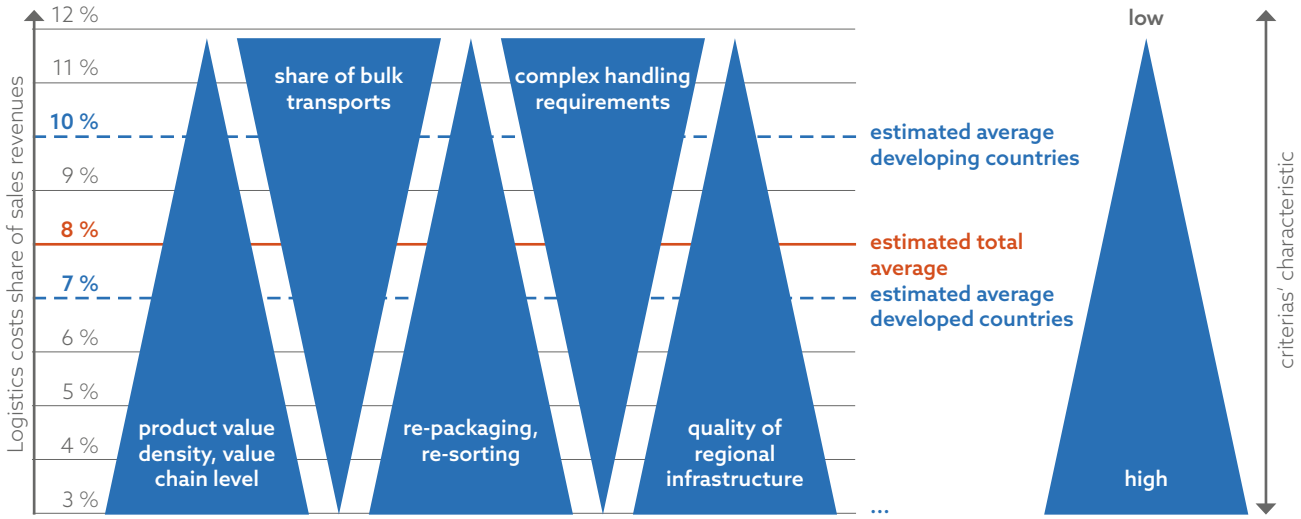



Figure 5: Average logistics cost shares and their drivers in the chemical industry

The quality of the local transport infrastructure and its flexibility for multimodal transport concepts has a large impact on this cost share. While Europe and North America have higher total costs, the overall share for logistics can be estimated around 7% due to the well-developed multimodal networks and more efficient logistics service providers. For the developing world, it was partially expressed with over 10% in the conducted expert interviews. With a majority of the total transport volumes located in the earlier steps of the value chain and an increasing share of manufacturing steps in less developed countries, an overall estimate for the average logistics spending of 8% of total sales seems feasible.

By transferring these logistics shares to the total size of the individual country markets depending on their stage of development, a pragmatic estimate for the respective logistics market size can be derived. This results in a rough estimation for the global market volume for chemical logistics of some € 283 billion in the year 2015. Nearly 80% of this market volume is distributed among the Top-10 countries in terms of chemical production which most notably include China and the USA, as well as many of the major western industrial nations such as Japan, Germany, South Korea and France but also all BRIC countries. With such a high market concentration in only a few major countries, local activities are compulsory for service providers who offer one-stop shop solutions.

The current trends in the chemical industry include the shift in commodity markets through shale gas developments as well as the shift of production areas to new developing countries such as the BRIC countries. This applies especially to basic chemicals but also to specialty chemicals. In addition, further acquisition and carve out activities continue and the break up/formation of companies is a major disruption factor in supply chain planning.

Fast changes of customer needs and increasing cyclicity of demand have an impact on the producers of specialty chemicals. Chemical companies are increasingly engaging in international cooperation, enter new markets and cooperate with local logistic service providers, sometimes experiencing challenges in terms of quality and safety provided.

## 3.3 Business Models in International Chemical Logistics

Chemical logistics is a heterogeneous subject – concerning the different criteria, different business models for service providers are possible. Regarding of these heterogeneous aspects, possible business models for service providers can be derived.

Figure 6 shows the spectrum of all possible specifications. The morphological box serves both for the systematic derivation and analysis of all the (theoretical) possibilities as well as the documentation and visualization of existing and appropriate business models.

| | | | | | | |
|---|---|---|---|---|---|---|
| **Basic orientation** | | Diversified | | | Specialised on chemistry | |
| **Objects** | **Dangerous goods** | Non-dangerous goods | | dangerous goods | | Highly dangerous goods |
| | **Handling** | Packaged | | Solid bulk | Liquid bulk | Gaseous / liqufied bulk |
| | **Loading equipement** | Pallets | Bags / small containers | Big Bags / Oktabins | Barrels/Tanks/ IBC | Pressurised tanks |
| **Activities / functions** | **Transport modes** | Road | Rail | Ocean freigt | Airfreight | Barge / Pipeline |
| | **Functions** | Transportation / freigth | | Warehouse | Value-added services | Planning and control |
| | **Process focus** | On-Site logistics | Procurement logistics | Production logistics | Distribution logistics | Integrated logistics solutions |
| **Management focus** | | Operational processes | | Tactical despatch – Procurement, production, distribution | | Strategig planning and control |
| **Customer focus** | **SC type** | Lean logistics | | | Agile logistics | |
| | **Production** | Continuousprocess | | Massproduction | Batch / campaigns | Customized |
| | **Product variety** | Single product | | Main product and side products | combined production | Various products |
| **Regional Focus** | **Local specifity of assets** | On-site assets | | | Off-site assets | |
| | **Global focus** | Local / regional orientation | | International sites and branches | | Global network |

Figure 6: Spectrum of possible specifications in chemical logistics

This results in basic business models of logistics service providers. There are service providers focusing on transport logistics, contract logistics providers offering complex logistics bundles including dispatch, warehousing and value-added services and service providers offering complex logistics solutions including planning and control of entire supply chain segments. In practice, the boundaries between these basic business models are often fluid – both specialized and diversified service providers offer a large variety of the services as described above.

Concerning the geographical focus service providers follow different strategies: "local heroes" focus their service offers on local and regional markets. Other service providers internationalize by following their customers in their internationalizing process and opening subsidiaries next to new customer's locations. Finally, global players strive for a complete global network connecting all destinations as well as a world-wide offer of their services.

## Key results expert interviews

For the selection of their logistics service providers the interview partners underline the importance of a global scale network as well as an excellent local expertise. Local expertise is seen of high or very high relevance by all interview partners  The picture is more differentiated regarding the global scale network – 2/3 of the interview partners regard it as very highly relevant, for 1/3 it is only of low relevance.

CHAPTER 4

# BOARDROOM

# 4 Boardroom Topics

## 4.1 Overview Boardroom Topics

The basic tasks of boardrooms include strategy development and implementation, initiation of mergers and acquisitions, and the establishment of objectives and supporting managers to achieve these goals (cp. Figure 7).

**OVERVIEW BOARDROOM TOPICS CHEMICAL INDUSTRY**

| OBJECTIVES | STRUCTURES | COMPETENCES | IMAGE/ VALUE |
|---|---|---|---|
| • Development / monitoring of strategic goals<br>  • EBIT / turnover<br>  • Market Share<br>  • Liqudity ...<br>• Meet Initiation of measures to achieve / decisions | • Initiation of structural developments<br>  • Merger & Acquistions<br>  • Product-/customer portfolio<br>  • Organizational structure<br>  • Investments | • Focus operating activities on strategic topics<br>  • Innovation<br>  • Cost<br>  • Safety<br>  • Liqudity ... | • Marketing of the company (Stakeholder)<br>• Optimization Image<br>• Increase company value |
| COACHING | | | |
| Coaching operational managers to perform the tasks, carrying out medium- and long-term decisions | | | |

Figure 7: Boardroom Topics Chemical Industry

The logistic topics, in the past, were not considered as topics of the board rooms because they were not classified as strategically critical for the success of the company. They were more seen as operational issues. This assessment is increasingly disproved in theory and practice as confirmed by the interviews conducted globally for this study.

» Logistics and supply chain management is like electricity: it is simply there doing its job. As long as it works, the executive board members do not pay it much attention. «

**An D'Haenens,** Global Manager Compliance, Sustainability and Logistics Enablement, EMEA Sourcing and Logistics Leader, DuPont Coordination Center

## 4.2 Logistic Topics in the Boardroom

Matching the key objectives of the boardroom with the current trends in the chemical industry and the special requirements of the international chemical logistics, delivers the TOP-chemical logistics topics for the boardroom.

### Needs in International Chemical Logistics:

In international chemical logistics, there are a number of requirements which are strategically critical success factors for the chemical company. This, of course, varies depending on the value chain in petrochemicals, basic or specialty chemicals.

In summary the critical success factors to be considered by the board are:

- **Value of the chemical logistics in the supply chain:** About 30%-60% of a chemical company's costs account for raw materials, while 20%-30% accrue in the production area (including supply of energies and waste - depending on the different value chains). International logistic costs mainly occur in the amount of freight and storage costs, site logistics and supply chain management (internal and external). With approximately 8-14%, they represent a significant portion of the product cost and financial statements. But logistics costs are only one side of the coin – failures in logistics can lead to substantial shortage costs, i.e. interruption in feedstock supply leads to downtime in production, delayed delivery of finished products may cause unsatisfied customers and a loss of sales at worst.

- **Degree of cross-linked international supply chains:** the value chains in the chemical industry are internationally connected to a high degree. Further refinement of products takes place across all continents, mainly Asia, America and Europe. This cross-linking has to be blueprinted and managed by the chemical logistics. This is done in the asset structure, transport hubs and routes. The advantages of an integrated chemical site network must be balanced by an effective integrated logistics network. The boardroom topic is to manage international complexity, integrate international networks of clients, suppliers and logistic service providers.

- **Safety, security and compliance along the entire value chain:** the guiding principle in handling chemical products, especially dangerous goods, is compliance with safety and security standards. The resulting damage due to accidents, both factual / financially and in image- / corporate value terms can have long lasting destructive effects for a chemical company.

- **Complexity of Chemical Logistics:** The complexity drivers include dangerous goods characteristics, a variety of necessary assets, local versus national logistics responsibilities, many modes of transport facilities, various requirements of sub-chemical industries and the physical states of the products. This complexity must be standardized in international value chains. Standardization means to install open, digitized IT-platforms, across key figures or overarching requirements.

These factors have a significant impact to the overall business of a chemical company and its success.

» Excellent Logistics and Supply Chain Management has become an important factor for success in the chemical industry. «

**Andreas Klotz**,
Director Supply Chain North America, Evonik Industries

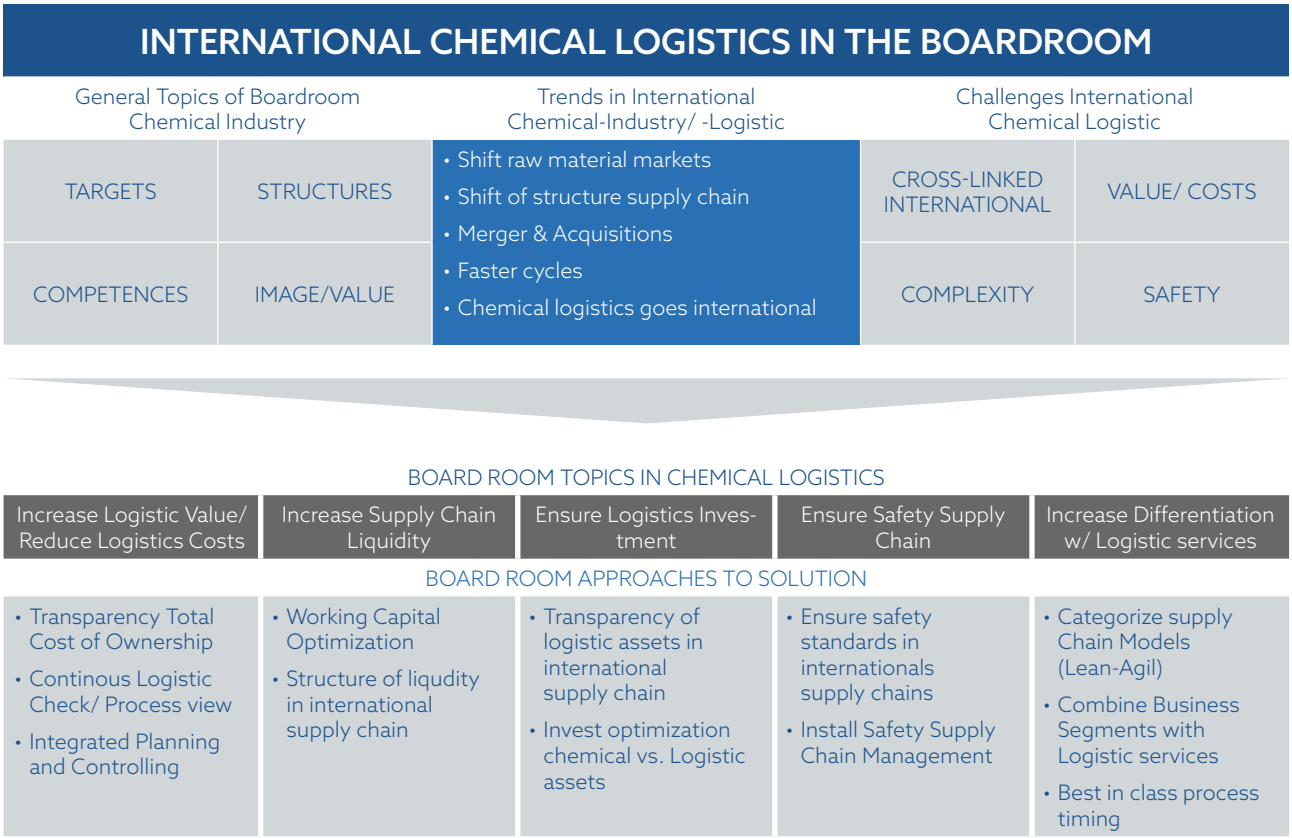



Figure 8: Chemical Logistics Topics in the Boardroom

## Approach to Solution in Chemical Logistics:

In consequence, the challenge for chemical companies is to address supply chain management matters strategically – to systematically analyze potentials of an elaborated logistics system as well as risks of logistics failures and disruptions in the supply chain.

The important role of logistics partners is only one aspect, the other aspect is to understand logistics as a core competence and hence to insource all important functions. Additionally, early involvement in planning is very important. The following approach should be applied by the boardroom to optimize their business and reduce potential risks (cp. Figure 8).

- **Reduce logistic costs:** The reduction of logistics costs today is too limited in scope of just further "pressing" the transportation rates. The requirement for further optimization is to generate transparency to the logistics expenses driver along the international supply chain. For this, the total cost of ownership shall be determined. The next quantum jumps are then accessible via a common integrated planning.

- **Increase liquidity:** In the value chain, working capital is bound. Many of the levers to optimize liquidity are thus found in logistics, e. g. just in time concepts, increasing inventory turns/ inventory accuracy or the raw material disposition.

- **Investments in international logistics assets:** investments in the production areas of the chemical industry often do not have the same payback values as investments in logistics. This is the strategic issue to decide which investments in logistics assets e. g. stock for non-dangerous goods or dedicated transport equipment make sense depending on whether chemical logistics is a core competency or not.

- **Safety in the international chemical logistics:** ensuring a safe supply chain is a fundamental task for the chemical industry. Essential is the implementation of a safety Supply Chain Management concept for each value chain.

- **Differentiation with logistics services:** The strategic differentiation of their chemical product portfolio provides a major challenge for chemical companies. The chemical logistics offers a wide range of opportunities for differentiation, e. g. agile distribution, and can be offered as an additional service to the customers in the chemical industry.

» It is very important for the board members to integrate logistics into strategic decision making in an early stage as the later logistics costs are largely determined in the design of businesses and assets. «

**Rudi Leonhardt**, Senior Vice President, Group Supply Chain & Logistics Services, Clariant

Overall it is necessary to have a supply chain strategy. In the logistics strategy the topics highlighted above, should be summarized. In particular, the logistics strategy should also determine if the international chemical logistics is a core competence or should be given to an external partner.

## Key results

Few companies attest their board a strong awareness of the importance of logistics and supply chain management. For most of the interviewed partners the head of logistics and supply chain resp. reports directly to the board. Especially in small and medium businesses often informal personal relations are anchoring logistics in the board. The responsibility of the CFO for logistics in many companies underlines that this function is very much seen as a cost factor.

CHAPTER 5

# VALUE

# 5 Value of International Chemical Logistics – Approach to Solution

## 5.1 Logistics Cost as the Central Element – Lean Logistics

For chemical industries, logistics costs are always a "basic factor" at a minimum – for some businesses cost is the only optimization criterion. Lean means that the cost structure of the chemical company has a significant problem with 1% or 2% more logistics costs.

» Cost management in logistics bases on transparency of all logistics activities. Optimizations can only be realized by integrated supply chain management. «

**K. Natarajan**, Chief Operating Officer,
Galaxy Surfactants, India

Pre-requirement of a comprehensive pro-active design and optimization of logistics cost is transparency in all elements that are to be attributed to this cost area. For several decisions in logistics (e.g. make-or-buy), it is of utmost importance that not only provided logistics performance is evaluated, but also that the full capacity of assets needed to supply these services in peak times are included.

» Successful cost optimization in chemical logistics cannot only focus on transportation – only a total cost of ownership approach (TCO) thinking supply chains from end-to-end enables us to optimize the total logistics costs with all their linked elements. «

**Dr. Dennis Fanelsa**, Vice President,
Regional Supply Chain Services Asia Pacific, BASF

In any case, in addition to the operational logistics processes such as transporting and storing, the administrative and planning processes need to be seen as well. In terms of the TCO-concept (total cost of ownership) the following cost elements need to be considered (cp. Figure 9).

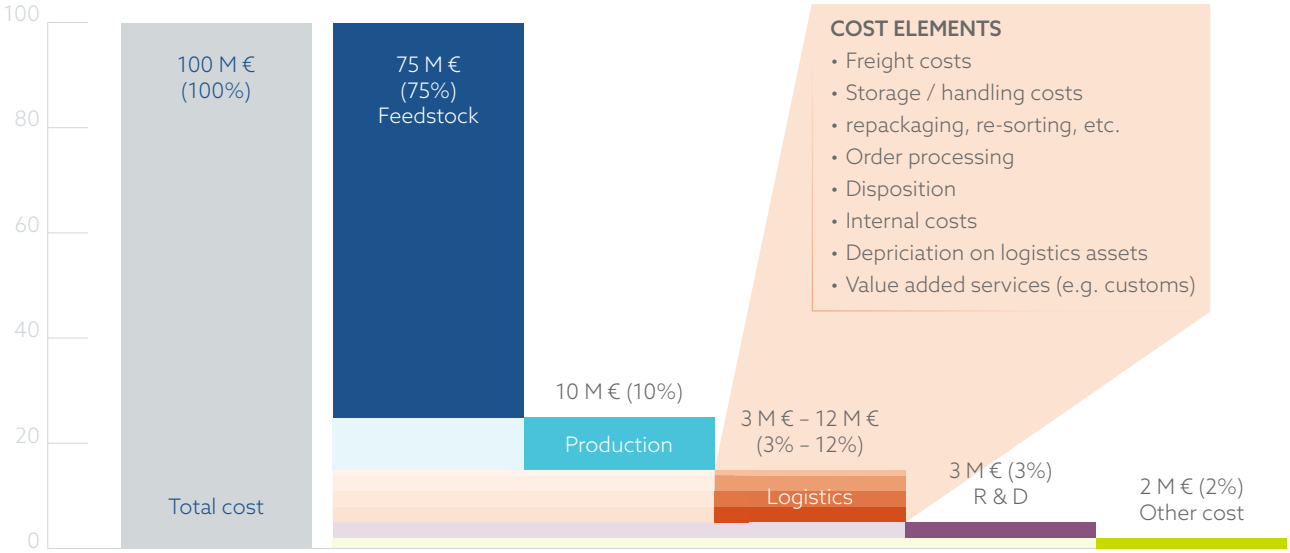



Figure 9: Total cost of ownership - cost elements „logistics"

The holistic approach requires a consistent "end-to-end" analysis of all these logistics activities. Only by this perspective the interdependencies between the individual elements can be made visible. As a "classic" example, the unilateral reduction of transport cost at the expense of storage costs and the costs of order processing can be cited here.

## 5.2 Management of Working Capital – Inventory Bound in the Supply Chain

Controlling the capital employed is of utmost importance for modern top-management to secure the companies´ liquidity and generate shareholder value. The shareholder value approach is seen as a chance to achieve competitive advantage while enterprises globally compete for the scarce resource of capital. Regarding the global financial and economic crisis and the increasing volatility of the economic and financial markets, this topic gains special importance as well for chemical companies.

» Logistics can significantly contribute to reduce inventory in global supply chains - the risk of operational losses due to stock-outs or delivery delay caused by reduction of inventory can be minimized in well configured supply and distribution systems with reliable logistics partners as other industries show. «

**Gerhard Blaess**; Senior Global Category Manager – Logistics, Axalta Coating Systems

Logistics has a direct impact on the amount of working capital bound in the balance sheet of chemical companies and thus on influencing financial key performance indicators such as economic value added (EVA) or return on capital employed (ROCE).

Figure 10 exemplarily shows the typical situation of inventories along an inter-continental chemical supply chain mapped in six generic supply chain segments.[9] The supply chain segments are described in two dimensions: cycle times by segment and capital employed. The scope/ expanse of the arrow for the individual supply chain step visualizes the heights of capital employed in this step. So capital structures along the supply chain are visualized and capital intensive supply chain steps are easy to detect.

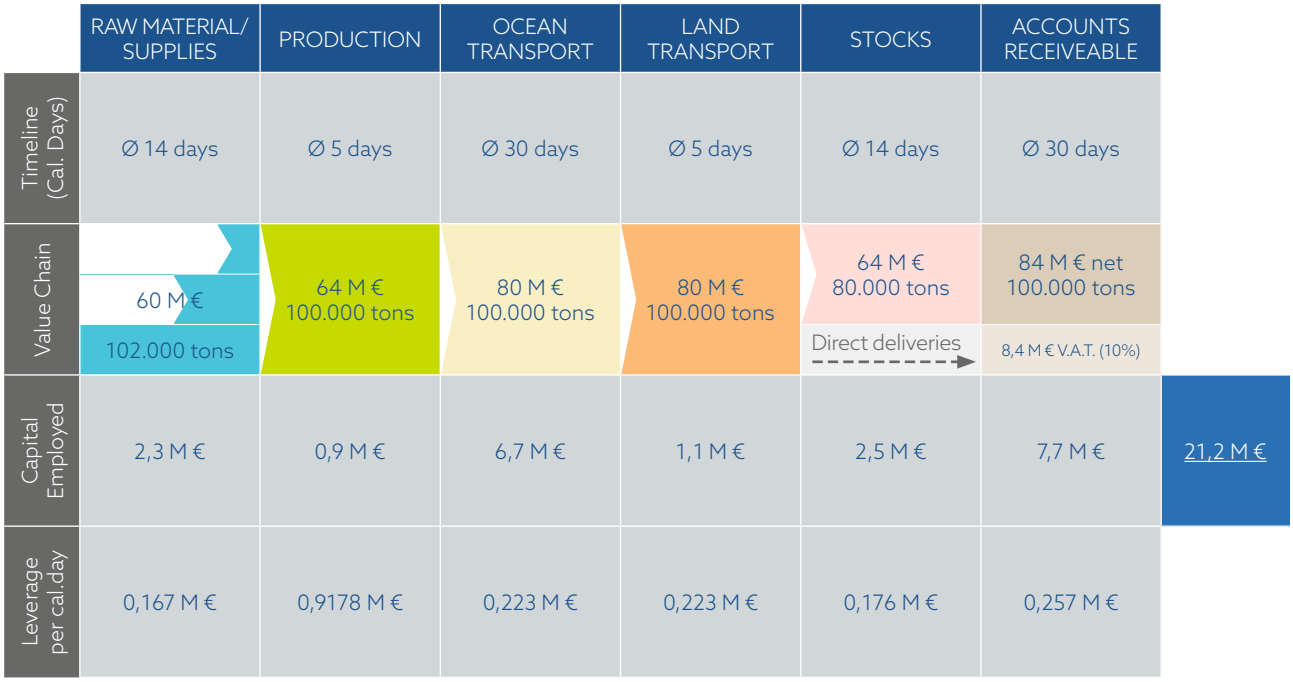



Figure 10: Graphical depiction of working capital employment – exemplarily for a typical chemical supply chain

## Key results

Most companies seek for solidity and resilience in their supply chains and do not (yet) focus on working capital management.
While working capital management has reached chemical companies boardrooms, it has neither (yet) arrived at a logistics level.
Innovative companies see it as one future "must win-battle" – other industries already show the importance of this logistics topic in the context of the value orientation in management.

## 5.3 Investments in International Chemical Logistics Assets

The decision to invest in assets and infrastructure, an extensive part in international chemical logistics, is a strategically important task of the boardrooms. The asset and infrastructure structure is differentiated between public and regulated access, transport-/ handling and storage infrastructure, the operator roles (producer, site logistic, logistics service providers), infrastructures for hazardous and non-hazardous materials and the local, national and internationally relevant infrastructure.

These relationships are shown in the following figure:

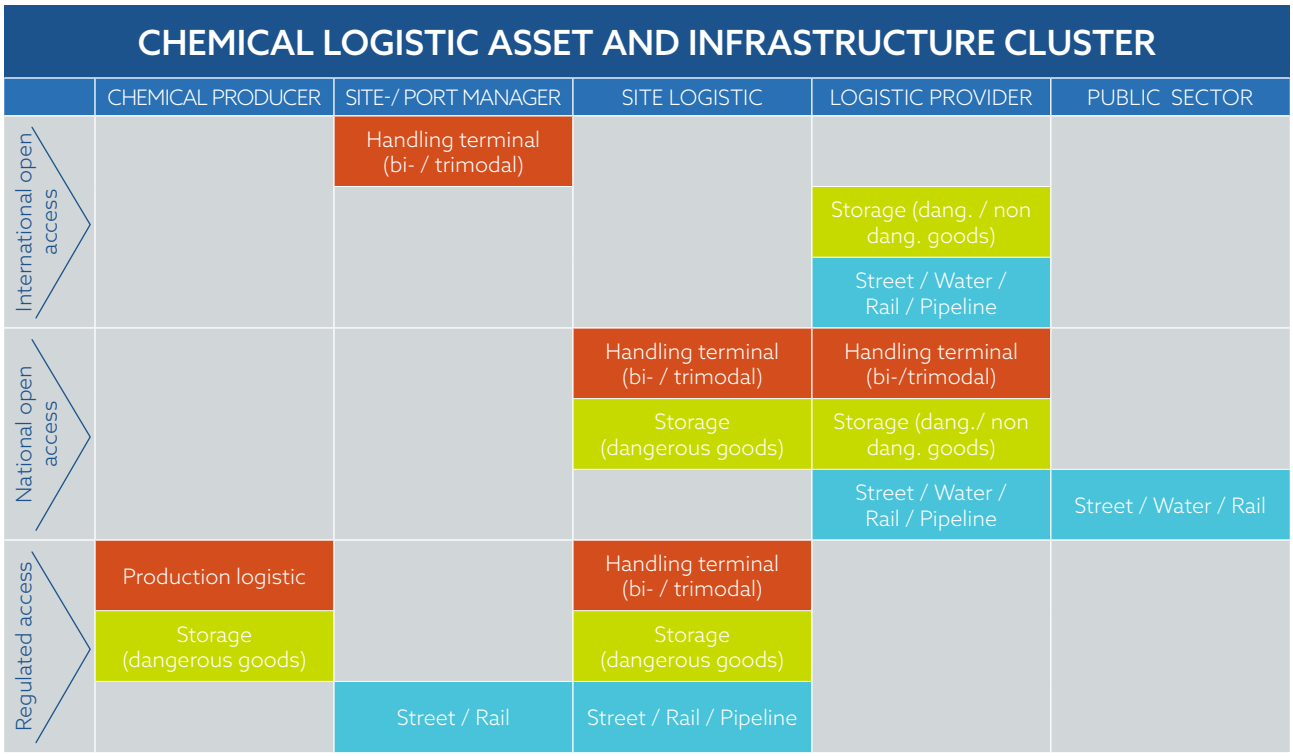



Figure 11: Asset Structure in international supply chains

- Which assets are nessecary for different value chains?
- Which investment is strategic for the chemical business?

The relevant decision paper for the board and its international value chains include the following issues that must be addressed in the individual infrastructure clusters:

### Asset structure for international supply chains

Depending on the customer, country and product structure different value chains are to be analyzed. Customer requirements are to be understood and converted into the demands on the supply chain. Optimal asset structures have to be derived for each value chain.

### Owner of logistics infrastructure

The question of the right owner depends on how to manage supply chains. This is critical to the success of the business. What happens when logistics processes fail in procurement, production or distribution stages and what impact does this have on production costs, customer satisfaction or on the image of the company? It is necessary to separate ROCE targets between logistics and chemical infrastructure.

The individual asset and infrastructure clusters should be checked for controllability, usability and efficiency. Industry and service providers need to seek a strategic dialogue on investment activities – both in transportation equipment such as dedicates vehicles or containers as well as in bricks and mortar such as warehouses and storage points for hazardous material.

## Key results

Innovative strength is not yet seen as an important criterion for the selection of LSPs and stated medium to low by the interview-partners - only for one company it is oh high relevance.
Companies demand logistics service packages from their LSPs that are based on well-working and right dimensioned logistics assets

## 5.4 International Safety Supply Chain Management

The objective (claim) of the global chemical industry and each senior management member is to ensure maximum safety when dealing with chemicals. The expectation derived for the boardroom strategic objectives are a 0%-accident rate and high expectations of people and equipment in handling chemical substances.

» Safety supply chain management is of utmost important for our company, as in the case of an accident it is the image of our company that is negatively affected, and the impact and implications to the society vary depending on the severity of which, even if it is the fault of the LSP. That is why we attach very much importance on reliability, chemical industry expertise especially expertise in dangerous goods. Our service providers have to bring the proof for their capabilities by the corresponding certificates and demonstrated track of performance, as ultimately we should all be socially responsible. «

**Carrie Zhang**, Global Category Leader (Deep Water Marine, Terminals & Surveyors), Logistics Purchasing

Boardrooms normally have in focus the topic of plant safety, where the requirements for a flawless and accident-free production are extremely high. The major safety challenges though arise when leaving the closed production system. These transfer points and the way from a predominantly closed production system to a next production-step, or to the end customer poses increased safety risks and these are part of the responsibilities of the chemical logistics entity.

Responsibility for the transfer points and the path cannot deliver the chemical producer and thus ultimately the management or board of directors.

## INTERNATIONAL SUPPLY CHAIN PRODUCT E. G. DIMETHYLSULFAT

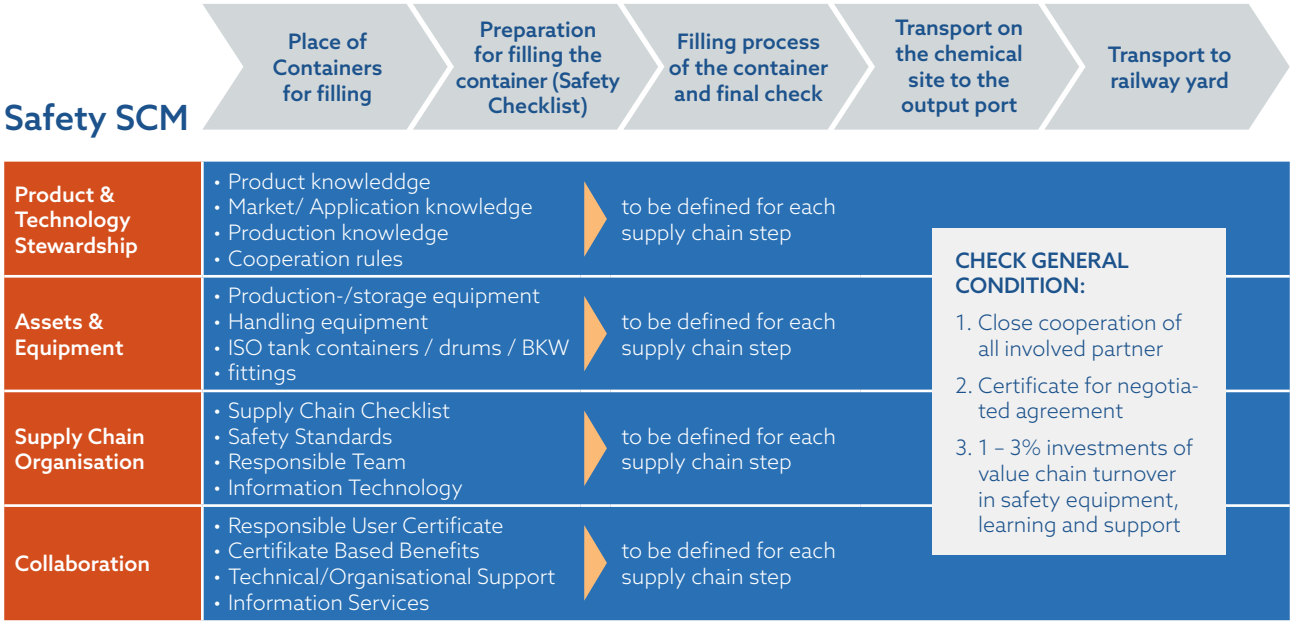



Figure 12: Safety Supply Chain Management

The introduction of safety supply chain management is a must for those involved in any international supply chain in order to ensure a safety standard across the entire chain. The safety supply chain all security requirements for each process step in the supply chain for specific supply chains (product, country, handling / storage locations, transport, technology, skills) are defined and agreed between the parties. A comprehensive safety support to ensure the promised security standard over the entire international supply chain has to be implemented by the partners.

## Key results

Safety Supply Chain Management is of top-importance for the selection of service-providers, which is reflected in the following selection criteria rated high:
Reliability is stated top by all the interview-partners and so (with the costs) the most important selection criterion.
Chemical industry expertise and industry knowledge is also of top-relevance.
Certificates (regarding sustainability, hazardous goods ...) are of very high relevance for all interview-partners, only two estimate it as medium relevant.
Compliance is seen as very highly relevant by all interview partners except one.

## 5.5 Differentiating Logistics – Types of Chemical Supply Chains and Logistics as a Service

Resulting from different market requirements for the different sub-segments of chemical industry and the resulting different business models of the manufacturers different basic types of supply chains exist. Defining these basic supply chain types helps to understand the particular role of logistics.

For the type „Lean Chemical Logistics", logistics is seen as a pure cost factor. Logistics has to work reliably, but its scope of influence on the design of the logistics chain is very limited. „Lean Chemical Logistics" can be found especially upstream close to initial production and feedstock.

The opposite extreme – "Agile Chemical Logistics" – focuses on the service aspect of logistics. Logistics is here seen as a means of differentiation and a possibility to realize a strategic competitive advantage. For this purpose, both industry and service providers must understand the specific characteristics and requirements of value creation, in particular the needs of clients and their customers. "Agile Chemical Logistics" can be found in downstream industries. These businesses are characterized by a variety of different products and product variants, sometimes even customized mixtures. In this case, production is only partly characterized by continuous processes. Batch production and even customer-individual physical processes such as mixing and blending are of growing importance with increasing proximity to end users and customers in other industries.

» Today the standard molecules are basically the same, whether they come from European, North American or Far Eastern competitors. Differentiation and advantage in the market place can be achieved by delivering value adding industry- or customer-specific logistics services. «

**Dr. Dennis Fanelsa**, Vice President, Regional Supply Chain Services Asia Pacific, BASF East Asia Regional Headquarters, Hong Kong

None of these perspectives is right or wrong. But it is crucial that a conscious decision is made for the "fitting" of logistics strategy in the respective business units and product lines. This decision requires involvement of top management. Just as it is done in the marketing of a product, differentiation on the specific customer groups and logistics services must be specifically defined. In this context, the question of who finally pays for the logistics services provided must be clarified.

The interviews with chemical companies suggested clearly that costs as a "hygiene factor" are always (and also will be in the future) a key criterion for logistics decisions. But on the other hand, almost all the involved experts state that the idea of logistics as a service plays an ever-increasing role. A commoditization across all chemical sub-sectors is taking place - competitive advantages over differentiated products can be very difficult to achieve. A differentiation against competitors can be realized only by quality and range of logistics services offered to the customers. The company able to handle the customer requirements for logistics best wins the business. Figure 12 offers a systematic approach to a segmentation of logistics services. The requirements for logistics have to be specified for each logistic segment individually.

## DIFFERENTIATION

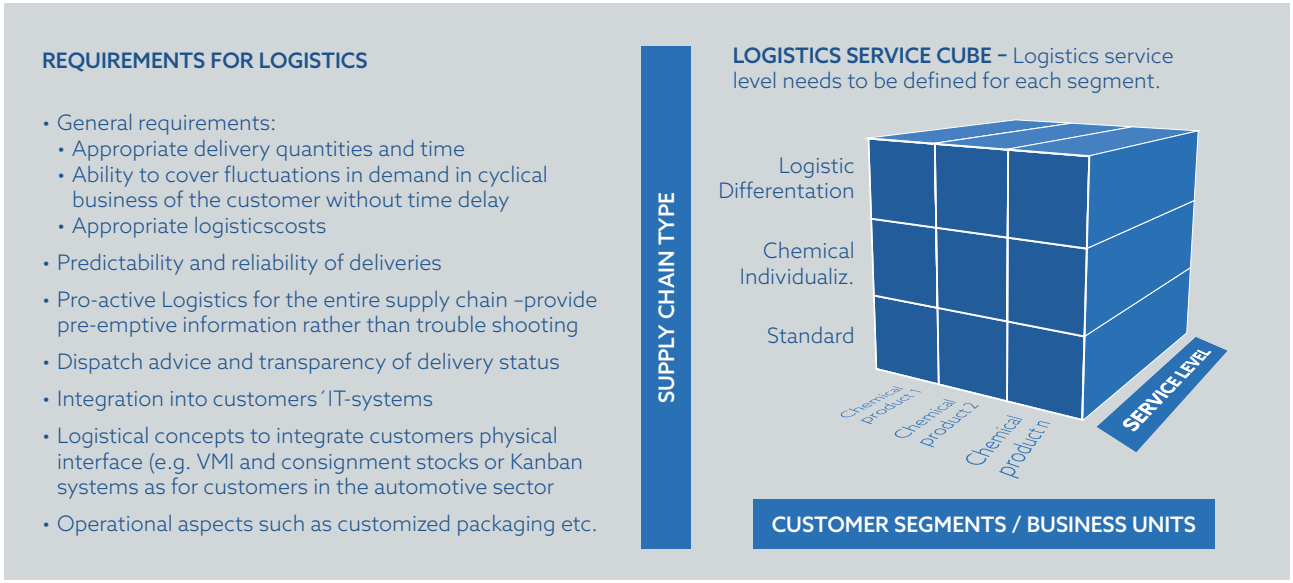



Figure 13: Requirement for Logistics and logistic service cube

Basic element for realizing this differentiated logistics strategy in agile supply chains is transparency about the logistics services offered. Often these service bundles are "grown historically" – in many cases triggered by the sales department and not agreed on with the logistics department. So sales orders can be won in the short run, but the impact on logistics and correlating logistics costs remains intransparent.

## Key results

To service customers most of the interview partners use agile logistics as a matter of differentiation from competitors with tailor-made services.
For inbound logistics lean processes and a cost reduction is in the focus of management.
Successful companies tailor their logistics service to business units, product lines and customers – there are businesses where logistics is just a cost factor that has to work, while in other businesses logistics is the means of differentiation and competitive advantage.

CHAPTER 6

# COLLABORATION

# 6 How Collaboration Helps the Chemical Industry - Lessons Learned

## Where there is challenge, there is opportunity

Chemical company boards do not usually regard logistics as a land of opportunity, but in today's environment it is well worth another look. Why? Smart SCM and logistics strategies can provide a much-needed counterweight to the tremendous complexity, risk, volatility and disruption that characterizes today's chemical industry. Smart SCM and logistics can be a force for stability and opportunity, and it can create significant value in two important ways.

- First, in an increasingly complex and unpredictable landscape, more strategic, robust logistics can increase a company's ability to manage and master the complexity. A smart logistics strategy can help smoothen the sailing through tumultuous times.
- Second, in an increasingly commoditized market, more service-oriented logistics can set a company apart from the competition. While other industries have already seized on this opportunity, its potential remains expandable in the chemical industry.

## Heavyweight logistics

Because logistics continues to be a significant cost factor, its "piece of the pie" when it comes to cost savings or increased supply chain liquidity is undeniably large. And because logistics is so integral to so many aspects of the supply chain, a smarter, more strategic approach can have a big impact on business stability, resilience and success. Customers will notice the improvement. At the same time, lapses in logistics safety can have huge – even catastrophic – consequences on the negative side. Either way, it is a heavyweight issue very much worthy of boardroom attention.

## BOARDROOM´S INTERNATIONAL SUPPLY CHAIN COCKPIT

| CATEGORY OF LOGISTICS-DESCICION | LOGISTIC DESCICION | DESCICION SUPPORT | |
|---|---|---|---|
| **Increase Logistic Value / Reduce Logistics Costs** | • How to get transparency in chemical logistics?<br>• How to quantify logistic costs vs. logistic value?<br>• How to integrate planning between client and provider? | • TCO-Approach<br>• Logistic Check<br>• Integrated Planning | Collaboration with Logistic Experts |
| **Increase Supply Chain Liquidity** | • How can we shorten the logistic chain?<br>• How do we handle raw material price vs. logistic optimization to reduce liquidity? | • Logistic Chain Capital | |
| **Ensure Logistics Investment** | • How we get different KPI´s for chemical and logistic investments?<br>• How decide which assets are strategic / core business? | • Logistic Chain Assets<br>• KPI´s chemical / logistics investments | |
| **Ensure Safety Supply Chain** | • How we can ensure 0% accidents in the logistic chain?<br>• How we get cooperations with top safety providers? | • Safety Supply Chain Management | |
| **Increase Differentiation w / Logistic services** | • How to enspire customers with perfect logistic services?<br>• How to stabilize prices with logistic service differentation? | • Logistic Service Cube | |

Figure 14: Chemical Logistic Decision Cockpit

The solutions derived in this whitepaper can only be realized if the chemical company and logistics companies are collaboratively working together. Mutual respect of each other's own core business on both sides is a prerequisite. It is important to understand the international chemical logistics as a value which is not expressed exclusively in the size or share of their cost.

» Only collaboration – not only in operations, but also in strategic matters – between industry, service providers, local authorities and universities leads to sustainable supply chain solutions in the chemical industry. «

**Rudi Leonhardt**, Senior Vice President, Group Supply Chain & Logistics Services, Clariant

## A start...

The five levers presented in this paper provide insight into five areas of opportunity, along with some initial recommendations for chemical industry executives and managers. In the limited extent of this paper these levers cannot be seen as exhaustive or applicable to all situations; they are intended as an orientation in the direction enhanced logistics capability for better bottom-line results. But they can give important impulses to improve logistics form an overall company perspective and consequently significantly contribute to overall company success – in the short and in the long run.

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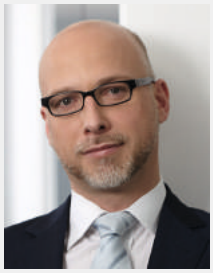
# COLOPHON

## AUTHORS


PROF. DR. THOMAS KRUPP
TH Köln -
University of Applied Sciences/
isi Köln GmbH



PROF. DR. CARSTEN SUNTROP
European University of Applied
Sciences (EUFH)/
Consulting for Managers in
Chemical Industries (CMC² GmbH)

UWE VERES-HOMM
Fraunhofer Center
for Applied Research
on Supply Chain Services
SCS



**EDITOR**
Kompetenzgruppe Chemielogistik
info@kompetenzgruppe-chemielogistik.de

**AUTHORS**
Thomas Krupp, Carsten Suntrop, Uwe Veres-Homm

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**INTERVIEW PARTNER**

- An D'Haenens, Global Manager Compliance, Sustainability and Logistics Enablement, EMEA Sourcing and Logistics Leader, DuPont Coordination Center
- Andre Hölzer; Leiter globales Supply Chain Management, Carl Bechem
- Andreas Klotz; Director Supply Chain North America, Evonik Industries
- Carrie Zhang, Global Category Leader (Deep Water Marine, Terminals & Surveyors), Logistics Purchasing
- Christian Harder, Regional Supply Chain Services Asia Pacific, BASF
- Dr. Dennis Fanelsa, Vice President, Regional Supply Chain Services Asia Pacific, BASF
- Gerhard Blaess; Senior Global CategoryManager – Logistics, Axalta Coating Systems
- K. Natarajan; Chief Operating Officer, Galaxy Surfactants, India
- Neven Bartel; Director Global Purchasing, Siegwerk Druckfarben
- Rudi Leonhardt; Senior Vice President, Group Supply Chain & Logistics Services, Clariant International
- Tarun Bhargava; Head of Global Customer Delight, Galaxy Surfactants, India
- Pre-tests of interview guide and practical sparring with experts in chemical industries from DHL:
- Giuseppe Polo - Director Business Development, Chemical Sector, Americas
- Michael O´Hara - Senior Director, Global Sector Head, Chemicals DHL Global Forwarding
- V. Anand Ramaswamy - Regional Account Director Chemicals Asia Pacific

Kompetenzgruppe
Chemielogistik

KOMPETENZGRUPPE
CHEMIELOGISTIK

Nordostpark 93
90411 Nürnberg

info@kompetenzgruppe-chemielogistik.de

www.kompetenzgruppe-chemielogistik.de

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