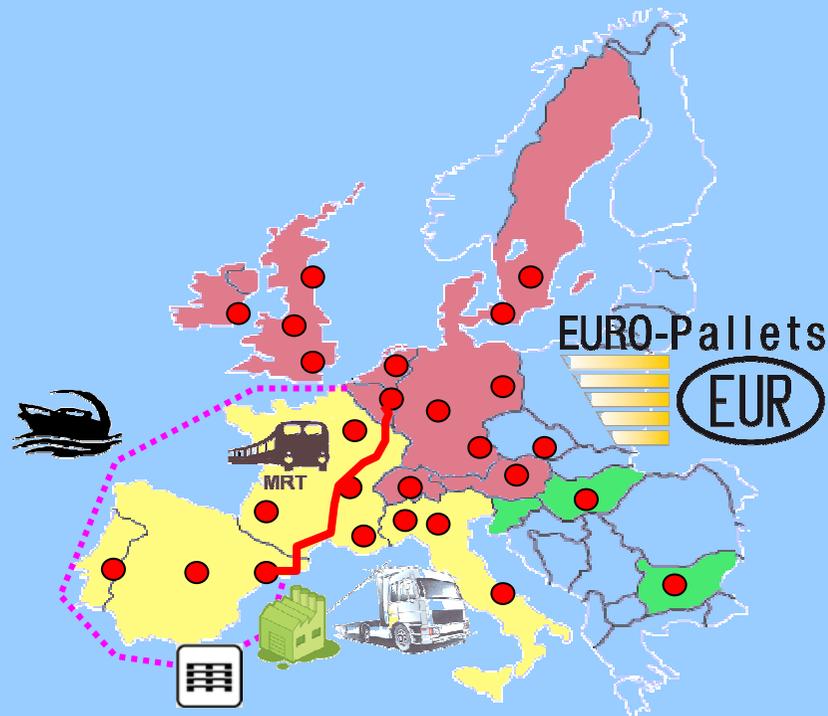




Vision on sustainable logistics for building materials



Version 19th September 2008



Préface

Dear colleagues, partners, and Stake holders,

At the occasion of the 50th anniversary of the European Federation of Builders Merchants and supportive industry, we have the honour to present with you our “State of the Union”.

In the past year, we have been working very hard on this project and wish to present you with our comprehensive view on a Sustainable Distribution of Building Materials in Europe. This message has also been produced in a “Moviebox”-format, which one can consult on our website: www.ufemat.eu.

This message mend for contractors, producers and national and European authorities. We tend our hand to start dialogue to optimise our mission.

More specific we address this to the European federation of contractors (FIEC) and the European federation of producers (CEPMC) in order to come to a covenant about partnership and collaboration.

We wish to thank our members for the confidence given the last 50 years, and hope to have a solid ground for the next 50 years!

We wish to thank especially EPAL and all the people helpful in the making of the document and the different movies.

Also the Belgian Federation, FEMA, the secretariat and the Management Committee, invested significant time and effort in this project. And finally, we wish to thank Geert Segers, Abraham Lingen, Paul Kuijpers and Geert Neutens for their work.

Géraud SPIRE
Président

Marnix VAN HOE
Secrétaire Général



Géraud SPIRE
Président Ufemat



Marnix VAN HOE
Secrétaire Général



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Management summary

Why this Ufemat logistic vision?

There is a strong need for new logistic concepts. Merchants and producers should discuss their visions to city authorities and politicians. To make good propositions Ufemat has developed a general logistic vision, from which every region has to choose their specific solutions.

Actual situation, challenges

In the coming years 50% of building production will be done in urban areas. But cities are dealing with increasing problems of congestion and quality of life. Nevertheless, building activities are important for cities to stay economical vital and attractive.

Building materials are about 20% to 25% of the freight transport into the city, so a relevant factor. This flow is responsible for a energy consumption, CO2 emission, air quality, and also for congestion problems. Transports are done in full truck loads, but also in partial deliveries. Mini-busses are used for building, many minibuses transport relatively low volumes. For merchants and producers city deliveries are an increasing problem, in terms of cost and reliable delivery times. More 'brownfield' construction sites are coming, with reduced space to store building materials or to unload.

Merchants are thinking about their future logistic role and about increasing their added value to their customers, while there is good chance that

professional logistic service providers will take over these logistic functions. Cities are thinking how to improve their accessibility and their logistic concepts. Time windows, heavy pricing and other regulations are introduced, but initiatives from the building industry could have more effects.

Top 5 problems:

- Congestion, leading to non vital cities
- CO2 and bad air quality
- Increasing energy prices
- Inefficient transport
- Low added value in logistics leads to access of new competitors

Way to improvements

→ Consolidation, high density transports in clean modes

The best way to improve is to eliminate transports. Successful cases (Berlin, London, Antwerpen) show that consolidation centres can have great effect on costs and congestion. Less transports should bring the materials to the building site, and should unstress the city. Low emission strategies lead new forms of combined transports. Standardized product carriers, like pallets and small con-

tainers could be very helpful. City consolidation centres (hubs) will help to create clean flows. The hubs may be permanent or temporary, public or private. Internet functions will bring together demand and supply. The use of water ways, clean trucks, cargo trams and other clean and efficient modalities may help, next to specific tracks for high density and reliable transports. Multi modal transport requires good economic conditions for fast and reliable crossdocking. Direct transports with full truck loads directly going to the building sites should be allowed as an efficient way of transport.

→ Just in time delivery to the building site, ready for use

Small innercity building sites (for example in renovation projects) should be provided in daily deliveries with a good consolidation, instead of a high number of low volume transports. These deliveries should be supporting to the organization of the building process, enabling high productivity, lower space required and higher quality. Besides these just in time deliveries should reduce failure costs because of damage or theft. Materials can be put into the building site on the right places in smaller units, for example directly on the right stock where the materials are to be used. They may enter the constructed buildings through (existing) windows, doors or

roof openings. A family of (different sized and combinable) product carriers will support this. Standard load/unload stations on the building site will stimulate fast and frequent deliveries to the building site.

- New high customer service, better partnerships

When constructors will share their information with merchants and producers, they are able to boost their services on industrialization and of logistic coordination. Prefab methods can help to speed up the building project, to gain productivity and to reduce inconvenience for the city inhabitants. But prefab solutions require better communication in all phases of the building process. The merchants and the producers need more transparency to improve their propositions to the client and the contractor. This will lead to more focus on minimum total costs instead of lowest price.

Solutions

For these concepts different kind of solutions are available, to be developed and to be adapted. In different combinations these solutions can be used for consolidated innercity logistics, just in time deliveries and in new customer services.

Make it happen

When acceptable solutions are available, competitive business players will use them in commercial concepts.

- Don't wait for cities to start. Individual initiatives of entrepreneurs from ufemat should be stimulated
- Public discussion between city authorities and producers & merchants, about their aorta and their support in improving the logistics of building materials and relieving the traditional city networks. This can be done in collaboration with other businesses, like retail sector or waste services industry.
- European merchants and cities should bring together their knowledge and experiences about consolidation methods and just in time methods. Economically interesting consolidation concepts for bigger as well as smaller construction projects should be available.
- EU should help to standardize the concepts (ICT, city boxes) for many European cities and building sites
- Challenging enablers to cooperate on new logistic concepts, like internet software providers, standard product carriers (like EPAL) and providers of cross docking technology

- Prefab concepts, for new buildings as well as for renovation projects, should be stimulated to speed up (innercity) building projects.

Top 6 solutions:

- Consolidation centres, leading to low energy costs/ton
- Specific innercity freight tracks, leading to reliable and clean transports
- Standard consolidation software (agent technology)
- Standard product carriers for flexible combinations AND for direct support of building site (like city boxes)
- Just in time methods, leading to less transports to the site and more productivity on building site
- Standard methods for transparent communication about the building process, leading to new fast building services

Conclusions

Public and private sector need to collaborate, to make great steps in better logistic concepts. But nevertheless the building sector can start themselves. Ufemat members can start discussion with city authorities, as well as with contractors and enabling parties to make their steps to a new future.

1. General introduction

Logistics of building materials is really relevant for accessibility and quality of life in cities

1.1 Why this logistic vision?

>> Urgency to change

Building industry is a big user of innercity infrastructure. The sector is responsible for about 20% of the good transports into city areas. Every dwelling takes about 60 to 80 truck transport movements, and then we don't talk about the enormous amount of movements of minibuses with building specialists. It is hardly a question whether we should continue these logistic practices in the next decades.

Earth, people, business and logistics are changing. People will always have building projects, but the methods and conditions for building will change. Figures make clear that almost 50% of the building



production will be in city areas. But congestion, air quality and energy issues will play a far more dominant role in building

logistics coming years. That is not only a public affair, there is certainly a role for building industry and suppliers itself. A proactive role and a dialogue is required to have a view on the future of innercity building logistics.

There is more stress on the building sector to improve their performance, in terms of environmental and economical performance, and in terms of client added value. Most of these performance improvements are to be realised supported by multiple actors and stakeholders. So communication and forming vision is very essential.

Regarding the future developments in the construction and logistic sector it's important merchants and producers in the construction sector know which role they want to fulfill and what added value they could have in the future. For traders there's a call to show more added value especially in their logistics. New building methods and increasing of innercity building projects might be asking the trader to fulfill an efficient logistic role so they are able to serve their clients as good as possible.

Vital cities need good conditions for building!

>> Cities have to find a compromise between economic activities and environmental impacts.

Cities are economic centres. All European cities are working on improving their economic positions and of increasing quality of life. Building projects are part of these economic activities, but not without problems. European cities have to deal with traffic problems, air quality problems and problems of bad connections. So time windows are set to regulate the traffic. It costs a lot of time to enter the city and to provide building sites with materials. And every city seems to set its own regulations.

>> Building material logistics are significant flows for every city. Experts have stated that about 25% of the product flow into cities is related to the building sector. So after logistics for retail and food/drinks, building materials play a really important role in inner city logistics. Not only because of the big trucks, but certainly also because of transport by small trucks or minibustransports.



Within the next years, more than 50% of all building production will be urban!

>> Customers of building materials want better logistic services. Clients in the building industry want the producers and providers of building materials to support them in their tasks. They want to build efficiently and customer-oriented, and they want to control their processes in costs and delivery time. Besides that they want them to help to operate in accordance with the local requirements and expectations. Because of a lack of qualified labour, contractors more and more work with prefab systems provided by the supplying industries.

>> Why this logistic vision?

The logistic vision obtains to inspire producers and traders to create new added values for their clients. Besides this improved logistic performance requires acceptable conditions in the city. Therefore the cooperation between the city authorities and the building industry plays an important role. A logistic vision will stimulate discussion and reflection on these conditions for the coming logistic future.

Ufemat wants to stimulate:

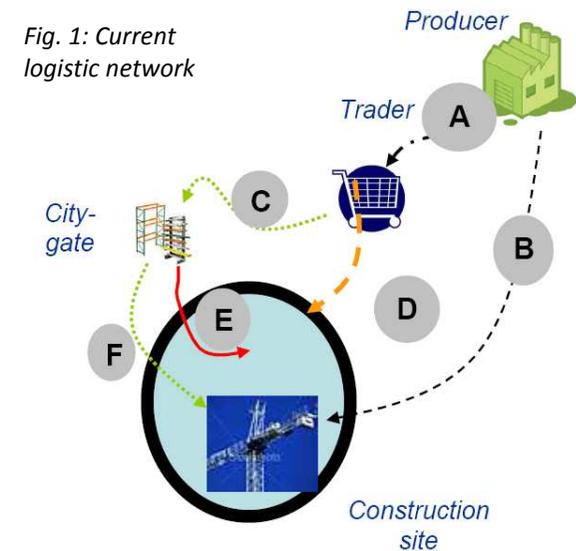
- a. Participating in solving societal problems in cities, and start dialogue with cities.
- b. Stimulating traders and producers to create added value to their clients.

To reach these goals, trends and problems will be analyzed, logistic strategies and challenges will be formulated and solutions and concepts will be created which eventually result in do's and don'ts.

1.2 The logistic chain for building materials

The current logistic network within the building branch notices several flows. Usually these flows are organized by the traders; contractors order their materials and the traders consider how the transport will be organized. This means transportation from the supplier directly to the building site gives the trader the role of organizer.

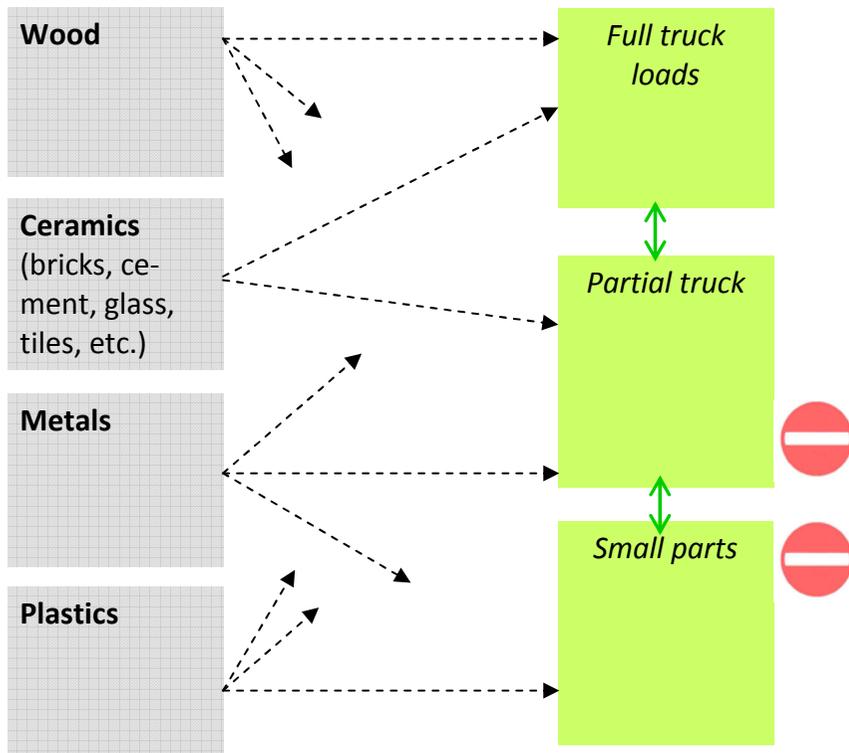
Because of the number of actors and innercity building sites efficient transportation might be difficult. Usually the contractors are lowest price oriented so they will go 'shopping' for their goods. If they just order all their needs at one big merchant, less transportation is possible, mainly because of higher efficiency. Nowadays, the load factor of transport of building materials is relative low, so cooperation between these actors might be resulting in lower logistic costs and less movements into inner cities.



Concentrating on the production of dwellings and utility buildings, one can see the production factories mainly produce their products within a certain family of materials. The figure on the next page shows a roughly partition in relation to the transportmode.

20 – 25% of total freight transport is related to the building branch!





City perspective

Efficient, durable logistics

Simple, Inefficient
Bad environmental Performances

Complex, inefficient, bad environmental performances, much road capacity needed

Fig. 2: Type of products- and transportation require other solutions

1.3 Trends

Looking at the construction and logistic sector three trends can be seen. The changing local circumstances, market situation and building methods.

>> Growing logistic costs, especially innercity

Costs of fuel, additional investment for clean vehicles, costs of congestion. It is clear that the logistic costs for building materials are increasing.

A Dutch company specialized on building dwellings is located in the north of The Netherlands and they are about the only one who build houses on the six small Dutch islands. Because of higher costs for transportation by using a ferry, they have organized their transportation very efficient. Decrease transport: 90%, decrease building process time: 75%, decrease construction waste: 90%

>> Environmental norms dominating, increasing local regulations on traffic London, Berlin, Brussels, Amsterdam, Milan, Barcelona, Koln, Rotterdam, and many other European cities have started to elaborate their own logistic policies and regulations. Energy consumption, CO2, fine dust, noise; local circumstances are changing due to more urbanisation and increasing congestion of cities. Local policies regarding entering cities result in different regulations, but overall lower tolerance on fine dust and noise can be noticed and more and more cities have time zones. The great variety of these individual regulations cause inefficient logistic schedules.



In general the construction sector is faced with increasing environmental regulations. The table on the next page shows the developments and effects on logistics, sorted by actor.

The building sites are supplied by the producers directly, or by the traders. In the logistic chain it is useful to make a difference in the 'full truck loads' and the 'partial truck loads'.

The different types of goods and transportation are different of character, and require other solutions.

Governmental measures about entering cities caused 30% more kilometres and over 450 million euro more costs!

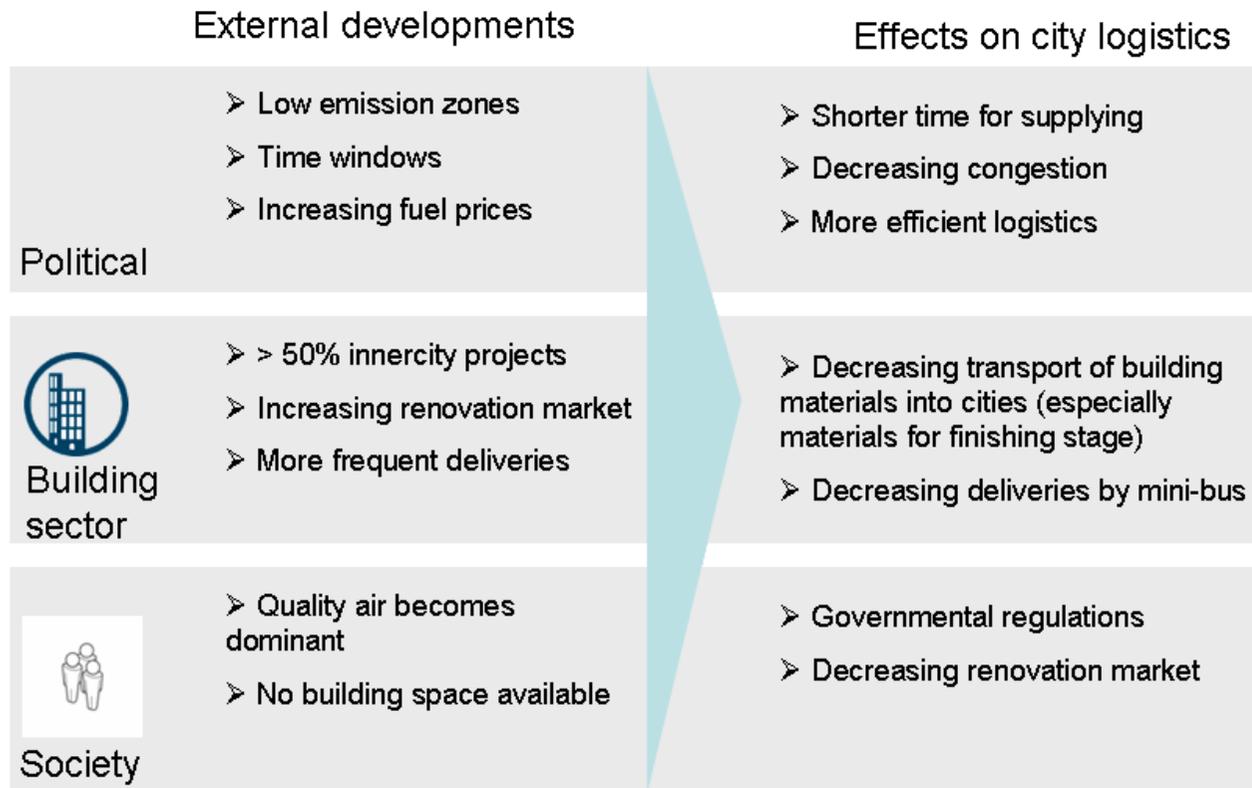


Fig. 3: Developments and effects on logistics

>> More building activities in the cities

More than 50% of all constructions projects take place in cities but instead of building new constructions contractors carry out more renovations. Most of the projects concentrate on increasing diversity in supply. Constructions differ in price and completion. Because of the extending diversity order quantities decrease as well as decreasing inventories which has led to central warehouses who serve the private and professional market.

Therefore contractors require other methods of deliveries. The need for efficient scheduling will be more and more important. To anticipate on these developments business to business relations are maintained via the internet.

>> Industrial building methods, with growing variety of materials

Smaller series and greater variety of buildings and dwellings have led to more complex logistic flows.

To limit the amount of transports contractors tend to more industrialized building. Prefabricated elements are being delivered and assembled on the construction site. As mentioned in the last paragraph, the just-in-time method is often used, mainly for small building sites because of the lack of storage space.

1.4 Facts & figures

There are several facts and figures that ratify the observed trends.

>> Increasing regulations on inner city logistics

A lot of cities all over Europe have special time windows for entering the city. Time windows close the inner city completely and only a select group can enter the city within established periods.

In The Netherlands it is also proven to be that government restrictions about supplying inner cities caused 30% more kilometres and over 450 million euro more costs because of taxes and fees to access zones.

There is also an increasing number of cities which have environmental zones e.g. the London Low Emission Zone (green shaded). Certain are not allowed in specific area's. Every year the regulations will be more and more strict. Polluting and heavy vehicles will have to pay a fee to enter the Congestion Charging Zone (orange shaded).

Transport twice as expensive? (per year, coming years)

1.	Cleaner trucks		5%
2.	Fuel costs	+33%	10%
3.	Driver shortage	}	5%
4.	European labour regulation		10%
5.	Toll and taxes		10%
6.	Transport shifts to sellers' market		PM
7.	Increasing customers demands		PM
8.	City congestion		PM
9.	Road congestion from 10% to		<u>20%</u>
10.	Carbon right on transport		<u>60%</u>

LEZ emissions standards (Londen)

- From 4 February 2008, a standard of Euro III for particulate matter (PM) for lorries over 12 tonnes
- From 7 July 2008, a standard of Euro III for particulate matter for lorries between 3.5 and 12 tonnes and buses and coaches over 5 tonnes
- From 4 October 2010, a standard of Euro III for particulate matter for larger vans and minibuses
- From 3 January 2012, a stand of Euro IV for particulate matter for lorries over 3.5 tonnes and buses and coaches over 5 tonnes.

At this moment it costs € 30,- to enter Londen by truck!

Fig. 4: Increasing transport prices

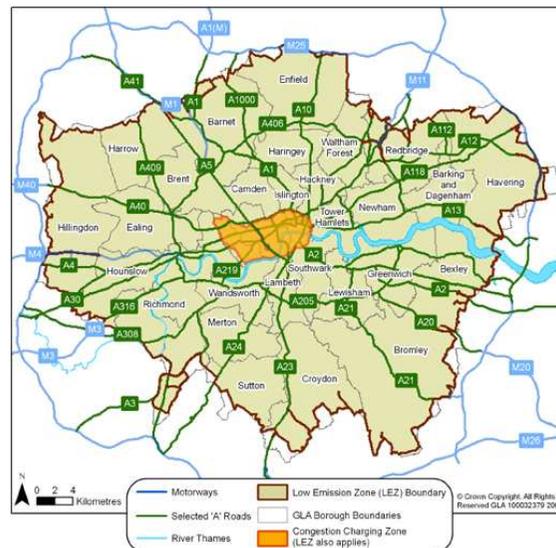


Fig. 5: Low Emission Zones Londen

>> Logistic costs will increase heavily

The causes of the increasing logistic costs are:

- Increasing diversity in supply
- Decreasing order quantities
- Central warehouses

>> Logistic cost structure

Logistic costs are determined by various cost elements. These cost elements are influenced by a number of factors, as shown below.

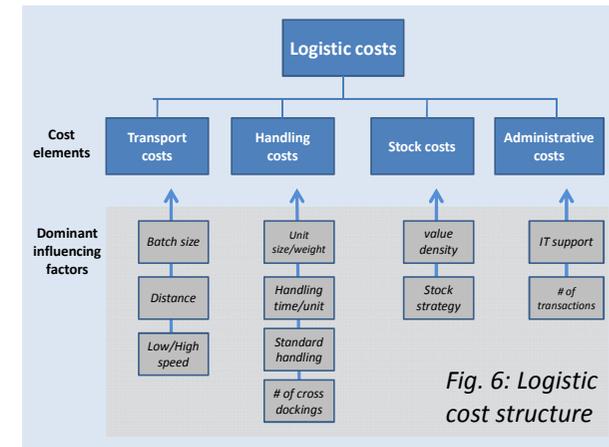


Fig. 6: Logistic cost structure

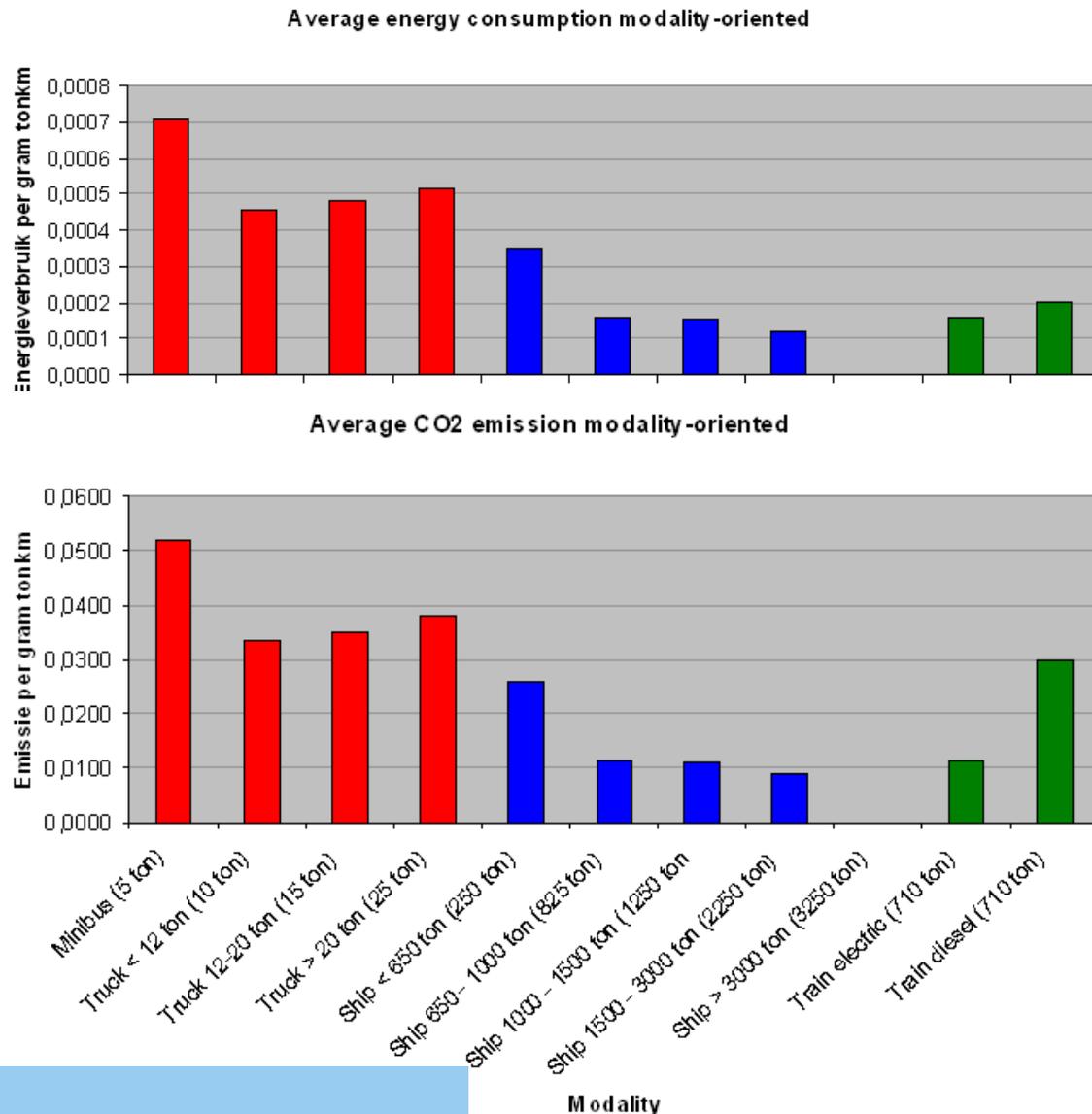
A ELA/AT Kearny study (1993) has shown that in general, transport costs are about 65% of the logistic costs, handling costs are about 20% and stock and administrative costs are about 7 to 8%. But for innercity transport, the costs of transport are reasonable higher (mainly because of congestion). Indicative studies shown that this almost doubles the total logistic costs.

In most sectors logistic costs (only for external logistics) are about 8% of the selling price of products (8%). So for innercity logistics they can be estimated to about 15% of the product price. These innercity logistic costs will increase, due to congestion costs and increasing regulations.

In the integrated logistic chain, also the stock costs of the contractor are relevant. For innercity building projects, he has higher costs for stock-areas, and higher costs for theft protection. These costs may be reduced by the supplying industry.



Because of the increasing fuel-prices and number of regulations about emissions, other modalities can play a role in new logistic concepts of supplying inner-cities. The partition of emissions comparing to different modalities plays an important role.



Each dwelling takes 60 – 80 truck-movements!

Fig. 7: Average energy consumption and CO2 emission by modality



The graphs on the previous page show the average energy consumption and the CO2 emission of different modalities.

Innercity-area's are the worst regarding CO2 emission and energy consumption. Because of this reason governmental measures will be taken. New methods of supplying innercities are interesting, especially in the construction sector (50% of the building projects will be innercity).

Focusses on CO2 emission, the table below shows the partition of CO2 emission by mean of transportation. Remarkable is the partition of minibuses. They cause a lot of emission comparing to trucks and transport less volume.

Transport			Kg CO2
People		20.800	Kg CO ₂
Goods		11.300	Kg CO ₂
	<i>Minibus</i>	<i>5.100</i>	Kg CO ₂
	<i>Trucks</i>	<i>2.600</i>	Kg CO ₂
	<i>Remaining</i>	<i>3.600</i>	Kg CO ₂
Remaining		4.300	Kg CO ₂
Total		36.400	Kg CO ₂

Fig. 8: CO2 emissions of transportation in kg

>> Logistic movements in building projects

In The Netherlands 70% of the national goods transportation expressed in vehiclekilometres exists of distribution movements. 25% of the

national goods transport is raw materials and building materials (expressed in weight) and about 30% of the transport by road is of these goods. The table below shows the average mass of a typical dutch dwelling and the number of transport movements.

Part / building material	Mass (x1000 kg)	Mass %	Truck loads (full)	Mini bus
Fundaments	38	22%	14	1
Bearing Construction	79	46%	28	1
Envelope Construction	29	17%	11	2
Roof Construction	11	11%	4	2
Finishing & installations	12	7%	1	>20
<i>Average total mass of a dwelling</i>	<i>169</i>		<i>58</i>	<i>>30</i>

Fig. 9: Average mass distribution of a typical dutch dwelling (source PRC Bouwcentrum, 1995)

In the different stages of a building project transportation can be done by the merchants themselves or by an external provider. The table below shows the partition. The data are based on a dutch survey (2008).

	Private transport	External transport
Heavily building	34,4 %	62,3 %
Finishing stage	22,2 %	16,8 %
Woods	17,9 %	10,6 %
Sanitary	17,5 %	6,9 %
Remaining	8 %	3,4 %

Fig. 10: Partition of private transport and external transport by product types

Partition of movements:

Heavily building stage: 22%

Finishing stage: 78%

NB. Renovation market (50%) generally finishing products

2. Goals and strategies for improvement

City authorities play an important role in making new logistic concepts successful

The congestion and environmental problems in innercity logistics should not escalate further. Public nor private sector seems to have their own key for solutions. Both are stakeholders, and only by means of partnerships real steps can be made. It seems that a lot of public and private goals can be aligned in new logistic concepts.

2.1 The city perspective: infrastructure as key success factor

European cities want to be attractive:

- ➔ good economic climate,
- ➔ nice to be and
- ➔ nice to live.

Therefore they provide their infrastructure.

The quality of infrastructure is a **key success factor for successful cities**. But most cities have a historical pattern of roads and infrastructures for transport people and/or goods. This total infrastructure has to deal with modern traffic needs.

Cities are searching for solutions for their congestion, their energy consumption and their air quality. It is not only a matter of creating better infrastructure, it also seems to be a matter of changed behaviour and use of infrastructure.

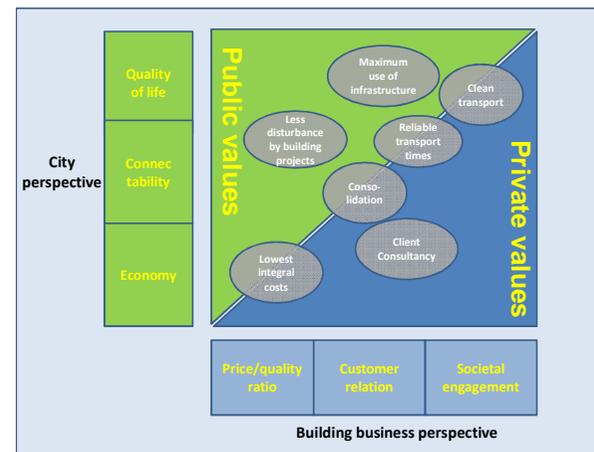


Fig. 11: Public- and private values of innercity distribution

Besides there is the **very unwanted disturbance of building project on infrastructure performance**. It seems more rule than exception. Innercity building projects are a major cause for unreliable transport times. It seems a good subject for partnering of public and private sector.

2.2 The business perspective: creating added value to your clients

City infrastructure is in general a public matter. Private partners are usually the users of the city infrastructure.

But business plays also a role in initiating new infrastructure. Companies can use available waterways, can invest in railway systems or can cooperate in getting special road tracks. Companies can participate in collective initiatives for better infrastructure. Take 'Les Halles' in Paris as an example of participative initiative. But public authorities can take the role of 'launching customer' to create space for inventive new infrastructure.

For commercial companies products and clients are their main focus. Products are to be attractive for their price- quality ratio. But not only this ratio is important. Clients want service. Their products should be in time, ready for direct use. So logistic functions are important for clients.

	New buildings	Renovation
Main construction process	A	B
Finishing process	C	D

Fig. 12: Various logistic market areas

Traditionally the building market is strongly price driven. Many clients have a shopping strategy, and they are focussed on selecting the cheapest alternative materials. It is expected logistic costs will be a growing part of the cost price, especially in innercity areas. Real low cost players should be capable of minimising logistic costs. For merchants is the question whether they can compete succesfull with orther logistic specialists. And



Fig. 13: Levels for logistic strategies

internet is expected to change the supply-demand relations heavily.

To stay competitive in the next decades, merchants and suppliers must take a decision about their strategy. There are several levels for logistic strategies for inner city services as depicted below.

2.3 The low cost strategy

In many material flows to the building site, low cost (max. efficiency) will be the dominant criterium. Contractors just want the lowest price to provide their building sites with the required materials. According to preliminary research results the distribution of the amount of deliveries directly to the construction site and the

amount of deliveries via a trader to the construction site is about equal.

When this strategy is chosen the transporter is faced with four challenges. First of all the wish for the lowest cost per kilometre will lead to the striving for

maximum load efficiency. Full truck loads are efficient and therefore cheaper.

The transporter will also seek for alternative modes of transportation. Shipping or a combination of transportation by water and road can cost less than transport only by road. This will lead to a competition in multi mode alternatives.

2.4 The high service strategy: providing the lowest integrated costs

An alternative logistic strategy is the high service strategy. In many cases high service strategies lead to closer client relations and forms of partnership relations. The costs are not the main concern but the level of service towards the client. It becomes important to create added value for the clients.

>> Responsiveness to new situations on the building site

The delivery speed of price can vary according to the wishes of the client. For example a client request for an emergency delivery can be granted for a higher price than the normal one, but still create added value for the customer. Especially in the renovation process unexpected deliveries can be necessary when an older building has to be modified. Responsiveness can have great impact on efficiency and speed of the renovation process.

>> *Lowest integrated costs by offering prefab options to the client*

Because of lack of well-skilled labourers, but also for economical reasons or reasons of labour conditions, contractors use more prefab solutions. During the building project they decide to construct the building on site or to use prefab methods. Prefab requires anticipation and special attention in the design and in the preparation. Traders can assist the contractor, so that he is flexible to select prefab components in a late project phase. The trader should be flexible to offer the right logistic methods for transporting and assembling (bigger) prefab components.

>> *Optimising customers logistics to the site*

Where the contractor is busy contracting the right subcontractors and managing the building conditions, the supply of building materials stays critical. He has to anticipate and make intelligent logistic combinations. But the contractor has not so much space for logistic improvements, in comparison of merchants and the producer. So they should be able to deliver better logistic services, as a logistic coordinator. In Holland the Topbouw innovation program launched a successful pilot with this new function of logistic coordinator.

The logistic coordinator may be the manager of the Just-In-Time supply process. This should be a reliable delivery, and it has the advantage that minimum storage place is required, and prevents different kinds of quality reduction on the building site. The logistic coordinator also may be specialised in nightly supply of construction sites, meeting requirements of maximum noise.

>> *Optimising customers logistics on the site*

Building activities are not always very efficient. Many workman are not only making their product, but also looking for their tools & materials, organizing new supply of materials, getting the right information, and getting rid of waste materials. As supplier of materials and tools, the trader of the future can create added value to support and optimize these logistic aspects for contractors and subcontractors. It creates conditions for easy working, and creates maximum productivity for skilled workmen. Getting the right materials at the right place the right time. But also getting the site free of waste material.

>> *Stock management on/near the building site (for sites with small storage areas)*

Stock place planning, theft protection, but also adding materials in time to the actual stock, will be a activity with added value. Especially for innercity sites, it will be very useful to do daily just-in-time deliveries with high reliability.

>> *Providing construction instructions*

Craftsman should get instructions for specific items. Tiles to be glued in the right orientation, radiators to be coupled in the right way etc. All this information is available in the traders showroom or at the producers experts. In the future this information will be electronically available on PDA, GSM or other new media. In the future you don't sell materials, but you sell a complete engineered solution. This will lead to lower integrated costs and more reliable solutions. Beside these forms of added values, other added value services may be possible.

>> *Challenges in the high service strategy*

When implementing this strategy the organization encounters some challenges. First of all the organisation must be equipped to deliver just-in-time. This requires more efficient product carriers (like pallets) and the components must be ready for use to really add value. Secondly the organization should have an intelligent system for the collection of goods and should for instance implement a site consulting concept. Knowledge of the customers process is essential to meet the expectations. This requires and improvement of the customer relations, forming an long term partnerships.

2.5 The low emissions strategy

Low emissions may be seen as a special competing strategy for commercial companies, it also can be seen as a 'license to operate': you have to meet the city regulations to be able to deliver your goods to your clients. Applying this strategy can be advantageous regarding future developments. Regulation will only become more strict. Adaptation can be very profitable, because shortening the entering periods results in higher distribution costs and more CO₂-emission as shown in the graphs below.

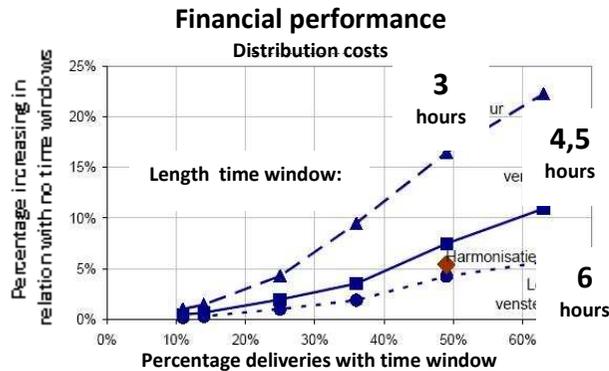


Fig.14: Extra costs of distribution in relation with length of time windows

>> Challenges in the low emissions strategy

For cities the challenge is quite clear: reduce the number of transport movements and maximize the use of ultraclean transportation modes.

Hybrid multi modal networks will help to create a mainstream of clean transport.

To obtain a 'license to operate' a transporter will have to create payable city-hubs. The load of large trucks must be loaded to different modalities. Future standards will also require a more frequent use of clean modalities e.g. hybrid networks and vehicles.

>> Consolidation as an important solution

Consolidation of logistic flows will be an important way of thinking. It may be private initiatives but can be set up as a public initiative (f.e. London).

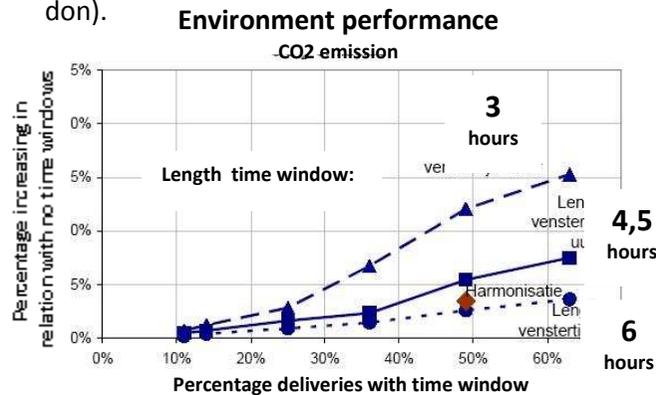


Fig.15: Extra CO₂ emissions in relation with length of time windows

*Research has shown:
Shortening the city entering periods (time windows) may result in higher CO₂-emissions and higher costs!*

Actor(s)	Examples of consolidation
Individual companies	- Combining different partial loads of different suppliers and building sites
Clusters of companies	- Creating consolidation centres for bigger projects
Public initiative	- Creating consolidation centres for different logistic modes on the edge of city areas (city hubs)



Fig.16: Local authorities close their cities



Fig.17: Bundeling different products



3. How to reach these goals

Many promising solutions are available, just combine them in new concepts

3.1 New city aorta structures

Every city needs a good logistic structure. Last years many cities got their innercity traffic ring. But it seems too riscul to be fully dependent on road networks only. Train- and underground networks have added logistic added value. Many cities are orientating on using their water ways too. For transport of people we see concepts that people drive to the edge of city, and then take their trains etc. So different transport modes are used to form the logistic chain. In the same way the freight logistic is expected to develop. Cities need to innovate their infrastructure to facilitate better logistic perform-ances. Their Aorta should meet the requirements of modern times.

>> **80/20 rule: main flow will be transported by the cleanest transport mode**

One of the concepts following the previously described strategies is the 'New city aorta concept'.

The 'New city aorta concept' implies a multi transport mode approach. Distribution can be done by water, road, rail or a combination of these and so form hybrid networks. 80% of all the logistic flows should be done by cleanest and cost effective transport modes.



Fig. 18: Distriroad: special roadtracks with high density traffic, ready for super trucks and with reliable short transport times. You have to reserve capacity. This network is free of congestion.



Fig. 19: City box in a dutch experiment

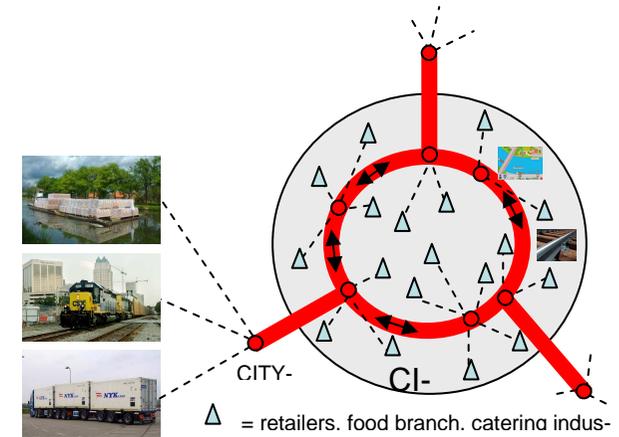


Fig. 20: The 'aorta-concept'

>> Multi modal networks for goods

This requires city-hubs at the edge of the city and inner city-hubs. Goods have to be transported to the city-hubs which then supply the inner-city hubs. The inner city-hubs are responsible for the handling and storages of the goods. Goods can there be unloaded from a big truck or a ship and loaded on another mode to supply retailers, the food branch, catering industries and building sites. In short: distribution to the end user. Final distribution requires professional logistic service providers for specific city areas and 'do it yourself' logistics. The removal of disposals can off course be done vice versa.

But why should we make such complex networks? Why not driving just to your building site destination? What's the advantage of these innercity multi-modal networks?



The advantages of innercity multi modal networks:

- High condensed transports in city areas (intelligent combinations of non-full truck loads)
- Less transport movements in city areas
- More investment potentials for improvements

Conditions / requirements:

- Positive economic exchange conditions
- Big enough scale of logistic activities (enough quantity)

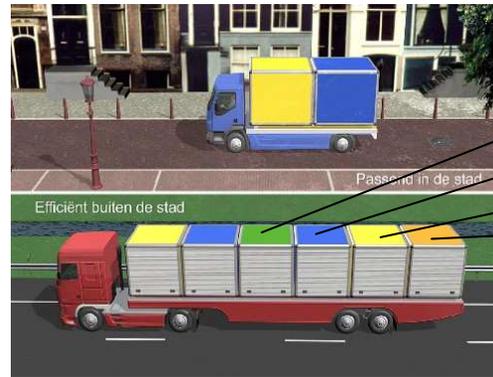


Fig. 22: City box – outercity truck – innercity small truck

It would be wise however when developing a new product -carrier to fit these on or make them suitable for example for the already existing pallet systems. This will minimize additional expenses for adaptation.

>> Innovative product carrier concept

A lot of the international logistic flows is dominated by containertransport. Much of the building materials are facilitated by pallets. Universal product carriers play an important role in logistics. For example the inventions of pallets and containers has changed the logistic traditions radically. Therefore the question is: what will be the product carriers of the near future?



Fig. 21: Standardized container for different modalities

Product carriers have a positive impact on logistic approach:

- Universal and widely available (not only for building industry)
- Easy transported in trucks, boats, trains (efficient)
- Easy to be handled in multimodal logistic systems. Low handling costs because of standard handling systems (low cost of multi modal exchange)
- Organisers and protectors, to be stapled on building sites.

>> Further wanted added value

Product carriers of the future will have more advantages. It should be possible to deliver them on building sites at night with as less noise as possible. This provides at least additional requirements for present product carriers.

Solutions

>> Ship solutions have good economic performance

Some examples of multimodal hubs using waterways have had promising results. Bricks that were traditionally transported by road were now transported by boat. The use of feasible product carriers (pallets in combination with pontoons) lead to an exchange performance of 150 pallets every hour, and so to low exchange costs. Ships use 5 times less fuel per tonkilometer than trucks. Ships at the moment are not very optimised. They use the lowest quality of fuel and the potential to improve is relatively high. But that will take some years. But in a future vision ships should be relevant.

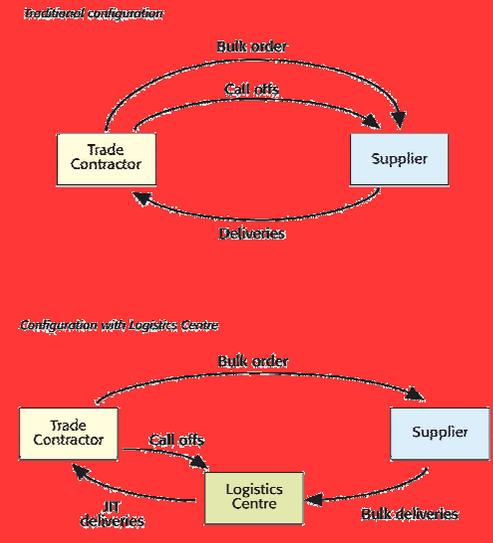
Many people tell that ship transport is only economically interesting when the transport distance is at least 150 km. So not for short distance transport. But this is changing...

London Construction Consolidation Centre LCCC

The London Construction Consolidation Centre (LCCC) was a £3.2m pilot study undertaken by a partnership of Transport for London Freight Unit, Stanhope PLC (the developer), Bovis Lend Lease (the constructor) and Wilson James (the logistics contractor). The Centre functioned from September 2005 to May 2007. It is now operated from a new site by Wilson James as a going commercial concern.

The Centre was a specialist facility to provide 'just in time' deliveries of materials to construction sites. This process consolidates deliveries on to fewer vehicles thus reducing congestion and emissions.

The process for the Centre's operation was that Contractors placed orders for their material requirements with their suppliers in their normal way, but instructed the delivery to be sent to the LCCC, not the construction site. Each day the contractors planned their next day's production and called-off materials from the LCCC. Materials were assembled and delivered, within 24 hours, on a vehicle that consolidated numerous contractors' requests. The LCCC received deliveries in a loading bay at one end and dispatched consolidated deliveries from a marshalling area located about mid way along its length. Call-offs were assembled, generally on pallets, in templates matching the delivery vehicle tray to ensure maximum utilisation of space available.



>> Experiments with city hubs (consolidation centres)

A city hub ('logistic terminal') in a case near Amsterdam (Holland) and near Menen (Belgium) have shown that the logistic costs can be reduced with 10 to 15 %, when all logistic costs are taken into account (also cost of final transport and costs of congestion). The pay back time of this terminal was calculated as no more than one year.

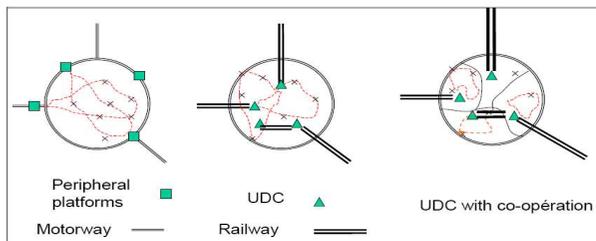


Fig. 23: City hubs

Special bike services are used for specific fast delivery services for retailclients in the innercity of Nijmegen (Holland). The bikes have a closed load floor (www.binnenstadservice.nl).



Fig. 24: Supplying by special bikes

>> Optimizing logistics on and near the building site

These concepts reduce loading costs because the loading of trucks becomes more efficient due to the standardised carriers. They can also prevent 'non full truck loads' because individual boxes e.g. can easily be placed on to the truck and unloaded elsewhere. Using compartment combinations with (other) packet transport can be made.

Such concepts can also be used as storage facility on building sites. The city box becomes an organiser and adds value to the logistics on the construction sites. In one of the next paragraphs this will be explained.



3.2 Just in time concepts for building sites

An important development regarding to deliveries to the building site, is the just-in-time component. Contractors order their needs at the end of the day by placing relative small orders. The proximate cause of this structure is the lack of space on the building site. Smaller orders cause more deliveries and probably less efficient transport. Especially regarding to supplying innercity building sites, it's important to deliver the building sites by an efficient way. Main conditions of this improvement are 'agents technology' and standardized universal product carriers.

>> The agents concept

Cost effective and low emission logistics, especially for non full truck loads, will be more and more dependent on intelligent combinations of logistic jobs. Half loaded trucks simply are much to expensive! You need to search combi loads.

Source locations and destination locations are to be matched in an efficient trip. ICT Agent technology is an important solution. This makes it much more complex to do your planning. So within the next years professional service providers will help to make these matches.

Or IT services will help logistic players to make good matches, or special distributing service providers will play this new role.

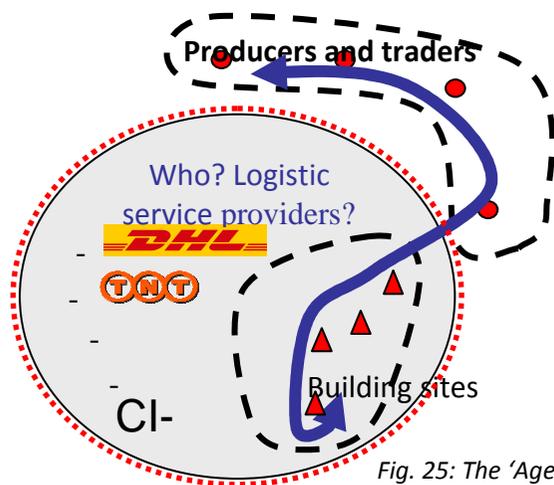


Fig. 25: The 'Agents technology'

The 'Agent concept' tries to connect demand and supply in an intelligent way to reduce the number of 'non full truck loads' in a certain city area.

The agent gathers the needed goods for an area in the city at the producers and traders outside of the city and transports these goods to the building sites.

So by combining transport jobs distribution is done with better consolidated truck loads. Preliminary Dutch research results produced the following data (indicative):

Vehicle type	Average load factor
Truck >25	77,5%
Truck 15>25	85%
Truck <15	78%
'Bakwagen'	60%
Mini bus	75%
Others	50%

Fig. 26: Average load factor by type of truck

Together with a combined deliverance to building sites in the same city area this results in a great reduction of (inner city) transport movements and off course emission. So the agent has higher load efficiency to the building sites but he can also exploit the return flow. The construction sector on the other hand will experience less robbery due to less storage on the building site it self.

>> Standardized universal product carriers

A concept as the 'New city aorta concept' requires standardised product carriers. It should not make any difference if the transport is carried out by road, water, rail or underground. The shape of such a product carrier should be a closable box so that it can also be used as storage space on the building site. Important characteristics of product carriers are: what are maximum sizes, maximum weight, and are they to be stapled.

UNIVERSAL PRODUCT CARRIERS



Fig. 27: Universal product carriers

Product carriers can be used to optimize logistics on the building site. Because of the standardised dimensions trucks can be unloaded quickly in inner city areas and directly placed in or on the construction site. This is because of the easy handling on building sites as illustrated in the image. The 'Innovative product carrier' concept can speed up the entire construction process while the distribution of goods on the site goes a lot faster.



Fig. 29: Product carriers for small products



Fig. 30: Containers as organisers for the dwelling finishing process

Solutions

>> Intelligent connecting demand and supply

The connection of demand and supply can be facilitated by internet solutions like E-bay. A similar internet site could be made especially for producers and traders.

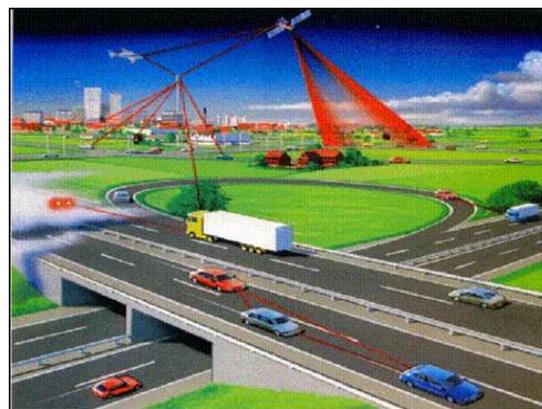


Fig. 31: This will be the future for complex logistic systems.

Another possibility is a real organisation, a special logistic company. Such companies can be erected for the long term or just temporarily. This has already been done in cities like Berlin – Germany, London – UK and Nijmegen – The Netherlands. In the harbor of Rotterdam the role of Intelligent agents is demonstrated. In a complex logistic environment it's not sufficient for all parties to make their own plans. Not in a central planning system, but in communicating distributed planning systems the logistic is controlled. Multi-agents have shown that they are able to make better plans than in traditional ways.



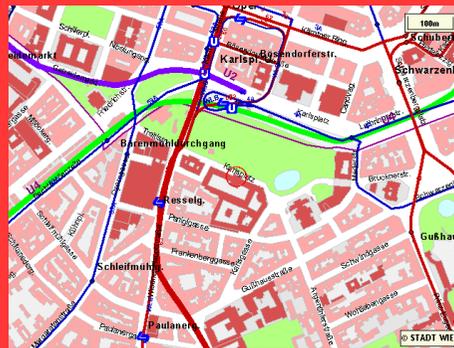
Kanban-system

Delivering the materials by standardized boxes gives the opportunity to make use of a 'kanban' system. Where supply time is lengthy and demand is difficult to forecast, the best one can do is to respond quickly to observed demand. This is exactly what a kanban system can do: it is used as a demand signal which immediately propagates through the supply chain. This can be used to ensure that intermediate stocks held in the supply chain are better managed, usually smaller.

Potsdam: special logistic company

The different Potsdamer Platz investors co-operated by setting up a legally independent company (limited) and transferred also legal rights and decision competence to this company. The major task of this company should be to control and monitor the logistics processes on the construction site. The company was led by only one managing director. All the control, coordination and monitoring functions were contracted out towards third parties (forwarders, lawyers etc.).

The benefits achieved are mainly related to cost saving due to a bundled procurement of construction material (about 10 Mio. tonnes), cost savings due to a commonly co-ordination of transport processes, a reduction in km driven on the road and an efficient disposal of soil from the construction site. The construction logistics company build the necessary in-frastructure.



>> Optimizing logistics on and near the building site

Solutions for optimizing logistics on and near the building site could be found in a standardized universal method of the product carrier. The handling of the unit between different modalities should be easy which has different advantages. Using standardized units, goods to innercity can be supplied by the aorta concept: the main flow will be transported by the cleanest transportmode and changing to another transportmode for final distribution would not be inefficient.

On the building site the product carrier should be delivered just-in-time and directly at the right place. For instance, materials necessary for the roof will be located directly at the right floor. In Belgium there is a supplier of roof-tiles specialized in the renovation market. This supplier has his own truck and is able to deliver the roof-tiles in a very short time, on the required floor.

Cooperation of the city and regional authorities is essential for applying this concept. Local policy are not informed and each city had his own specific measures, restrictions and possible environmental zones. Nevertheless, this concept can be very profitable as illustrated in the example of Potsdam.



Fig. 32: Gyproc's Python is a combination of a compact truck equipped with crane and a separate trailer



3.3 Consultancy services in transparent processes

A transparent process of the contractor makes it possible other actors in the logistic chain can serve more efficient. Traders and producers can do this by creating conditions for industrialized building methods starting in the design phase. Afterwards they can help to control interfaces between the various building components and provide reliable instructions to personnel. Besides that they should organize clean and accessible construction sites. To add value to the clients process logistic information from the building site has to be communicated to the trader or producers. This can be done by:

- Webcam, CAD planning and delivery schemes
- Logistic coordination on distance
- View on building methods and speed
- Stock management: view on actual stock situations
- High response: fast deliveries, high service
- Integrated intelligence to combine logistic flows

For traders and producers it will be very important to improve partnership with the contractor. In general craftsmanship on the building site is reducing. But to industrialise the building process, it should be well organized. Traders and producers will play an important role. They will upgrade their partner role and anticipate on the clients demand. In this way they should upgrade their added value to their customers.

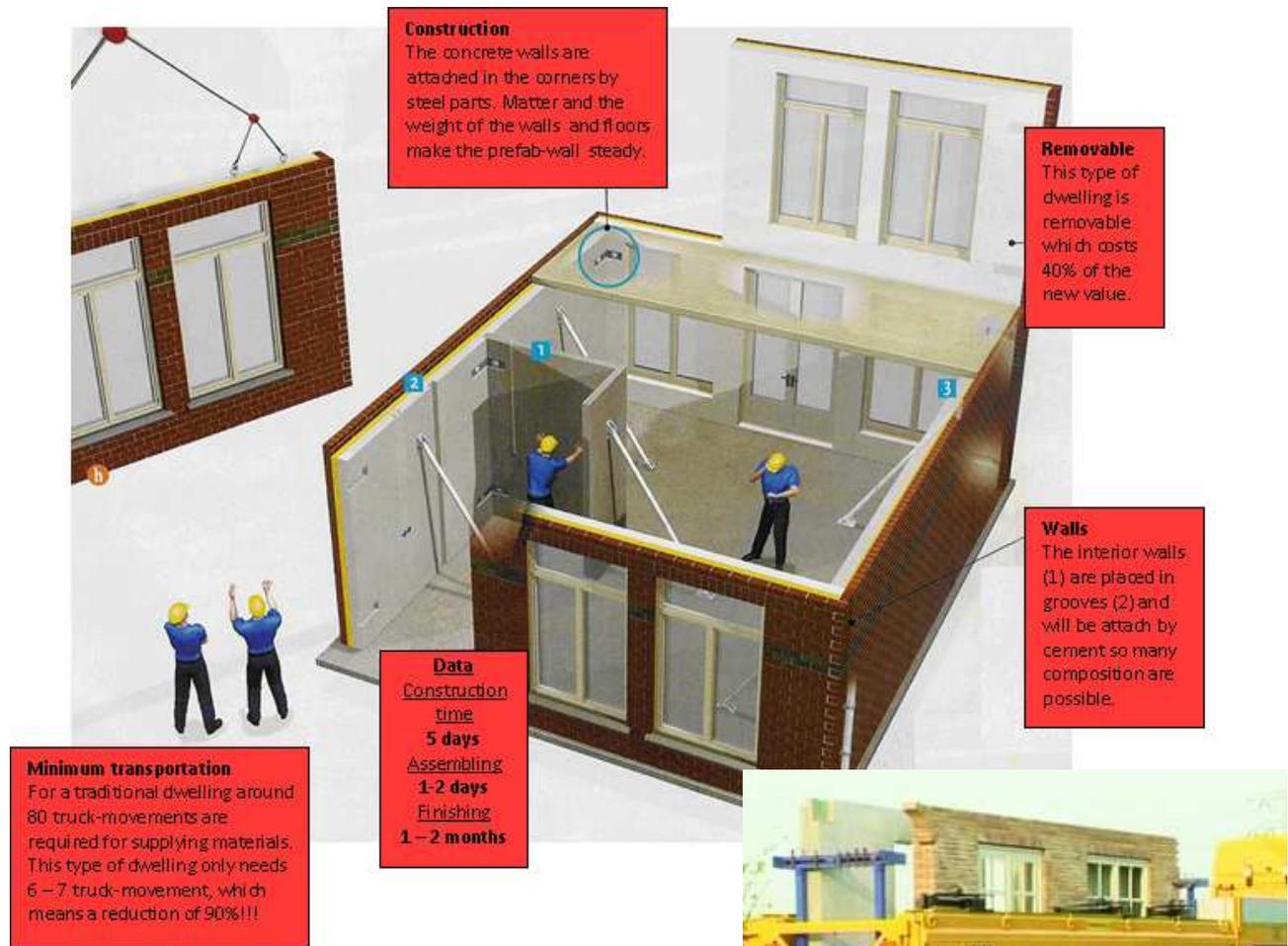


Fig. 33: Pre-fabricated dwelling

The figure above shows an innovative dwelling, which can be build in only 5 days! All compartments are prefab solutions which are be made in the design phase. In only 6-7 truck movements all the elements are delivered and are ready for assembling.



Only 6 – 7 truck movements for building this dwelling!!!

>> Traders and producers should have suitable computer systems to meet expectations, but this approach also requires a representative or representatives related to the building site. Building site support service gives clients the opportunity to manage the building process more effectively. The trader should be able to read CAD data of the building project, as well as scheduling data. The trader can do propositions and consults to the contractor or to the client. Besides he will be in dialogue with the contractor concerning the material logistic system.

In the United Kingdom a company made a delivery management system for construction sites. Scheduling deliveries efficient might improve logistic operation on today's construction sites. The program is a multi-user diary for booking Trade Contractor deliveries, material removals or any other vehicle movements on and off site. It is possible to make the diary available to anyone who needs it via printouts, large screen displays, over the network or via the internet. Deliveries can be booked, muck and waste removal, Crane time, Hoist time, Loading Platforms, Fork lifts etc.

<i>High service aspect</i>	<i>Consequences for product carrier</i>
<i>Responsiveness</i>	<i>To be transported in different kind of trucks, trains, minibus</i>
<i>Offering possibility of prefab methods</i>	<i>Carrying and protecting bigger prefab elements</i>
<i>Optimising customers logistic to the site</i>	<i>Traceability. Reduced cross docking costs</i>
<i>Optimising customers logistic on the site</i>	<i>Organising functions. Efficient handling by available cranes and other Logistic equipment.</i>
<i>Stock management</i>	<i>JIT kanban functions, stock control on distance. Theft protection.</i>
<i>Providing assembling instruction data</i>	<i>Coupling materials to instructions data</i>
<i>Intelligent combinations of logistic flows</i>	<i>Universal product carriers could be stapled</i>

Fig. 34: High service solutions and the consequences for the product carrier

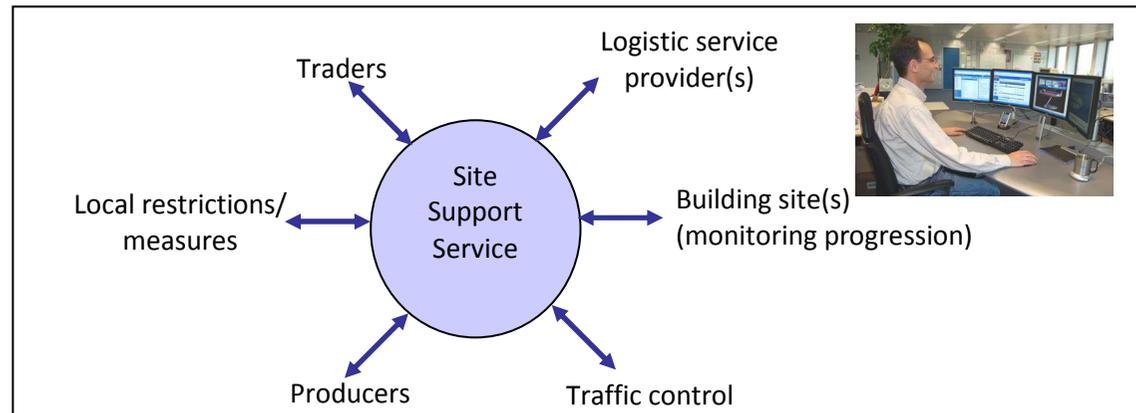


Fig. 35: Site consultancy services

4. Do's & don'ts

No guts, no glory!

4.1 New city aorta structures

>> New business roles producers and merchants

- Cluster with different business sectors to have a dialogue with city authorities.



Fig. 36: 'Freight-tram'

Where a transporter used to be charged with making a planning to transport the goods from A to B, he now had to plan from A to D via B and C. Higher level logistic management is needed to meet expectations. When the transporter had such a system however it can also be applied for other business such as retail, food or even the entertainment industry.

- Providing software for communication and planning on consolidated freight transports
- Providing final distributed transports to building sites

- Exploiting fast city cross docking stations and stock management

The development of innovative product carriers requires specific knowledge. Some of the European traders and producers all ready have this expertise and can therefore seize this opportunity: create a new standard! A new carrier desired by the building sector to minimize costs.

- Standardizing product carriers (like 'euro city box' or pallets)



Fig. 37: Ships with own cranes delivering building materials on innercity stocks

Make it happen – Do's and Don'ts

DO		
Actor	To do	Result
Ufemat	Put this logistic vision in discussion with European cities. Discuss the potential of alternative logistic modes. Fit these generic solutions into city specific infrastructure.	Awareness
Industrial partners & European cities	Connect different European experiments with logistic innovation.	Networks for fast learning and fast innovation

DO		
Actor	To do	Result
Ufemat & European contractors	Make a yearly scan of logistic innovations, stimulate visibility.	Inspire first adapters
EU, Ufemat & European contractors and universities	Stimulate national/regional logistic innovation programs, with special attention to building material logistics	Know how about successful network innovations
EU & European cities	Standardize regulations	Equal playing fields
EU & European cities	Facilitate conditions for clean and consolidating transport modes, and for city hubs. Create area for innercity hubs	Space for system innovations
EU & European cities	Make CO2 and sustainable logistics a	Market effects on durability

	practical selection criterium in tender procedures.	
Cities and universities	Define logistic key performance indicators and benchmark.	Learning by benchmarking
EU	Create space for regional experiments, and challenge innovative parties and cities	Best practices

DON'T		
Actor	NOT to do	Result
Cities, EU	Do NOT let all cities make their own regulations	
Ufemat & Industrial partners	DO NOT wait for public initiative for new logistic concepts.	

4.2 Just in time concepts for building sites

Just in time concepts for supplying building sites are concepts to reduce the number of innercity transport movements and to provide more efficient logistic on and near the building site. The following business roles of authorities, producers and merchants are activities/conditions to make use of these just in time concepts.

- >> **New business roles producers and merchants**
- ➔ Providing a (payed) logistic coordinator role, intelligently controlling material flows to the construction site
 - ➔ Providing kanban software for optimal delivery
 - ➔ Standardizing modules for site stock stations; drive in, take old container, place new one, and get away

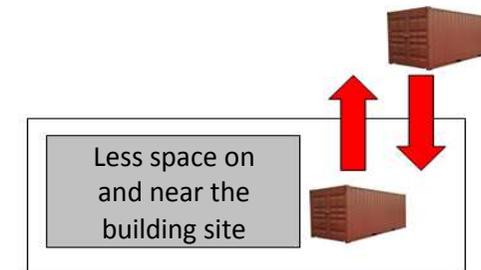


Fig. 38: Storage on the building site by containers

- ➔ Providing special transports for putting building materials into higher building stocks
- ➔ Night delivery specialists

Make it happen – Do’s and Don’ts

DO		
Actor	To do	Result
Ufemat, European contractors & Europollet.	Develop standardized solution for building site supply, like container/pallet solutions in a JIT environment.	Fast adapted new solutions.
Ufemat	Create standardized compact solutions for building site storage/delivery.	Low cost standardized solutions
Ufemat, European contractors	Create container solutions for secure and quiet night deliveries	Better use of infrastructure capacity
Producers & merchants	- Communicate this vision to your city authorities. - Start discussion. - Consolidate, find partners. Use JIT software.	
City authorities	- Require just in time deliveries	

	in the cities. - Providing innercity stock areas. - Stimulate universal IT solutions for all cities, avoid city specific solutions - Communicate experiences by business cases	
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DON'T		
Actor	NOT to do	Result
Producers & merchants	Defragmentate in individual merchants	

A concept like the 'Agent concept' creates a new market. Binnenstadservice.nl is an initiative in Nijmegen to provide a distribution service for the inner city. Environmental friendly transportation modes are used to provide the inner city with goods. Pollution vehicles which do not meet environmental standard for the inner city gather at a meeting point. Their load is then jointly loaded on cleaner modes sorted by street and will be distributed. The purpose of this initiative is to create a better

reachable, clean and healthy city which also can function more economically compared to all the separate logistic flows.

4.3 Consultancy services in transparent processes

Up until now the coordination is scattered. There is not one organization which has the complete overview. Clients could be helped by filling this gap. This service can also be used by other parties and sectors.

>> New business roles producers and merchants

- ➔ Establishing long term partnerships between contractors, merchants and producers
- ➔ Providing tools to 'publish' the contractors data to his partners
- ➔ Providing intelligent software tools for analyzing building processes and CAD models
- ➔ Providing intelligent tools for analyzing the consequences of prefab solutions
- ➔ Providing on line prefabrication propositions to the contractor, to ease his work
- ➔ Prefabrication role, to reduce the constructions times significant
- ➔ Special logistic service providers for bringing and installing heavy prefab components

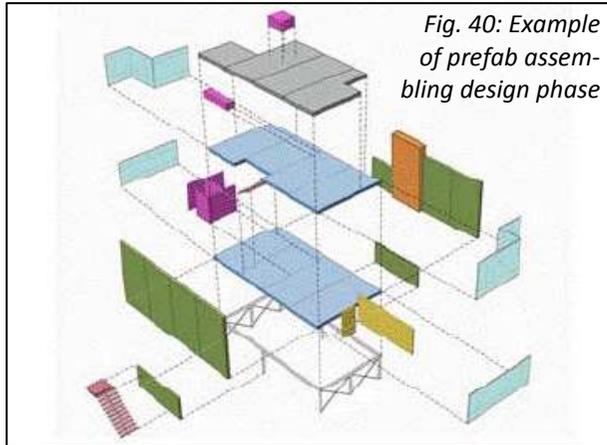


Fig. 40: Example of prefab assembling design phase

Make it happen – Do’s and Don’ts

DO		
Actor	To do	Result
Cities & ufemat	Standardize communication and intelligent logistic functions (ICT) for consolidation and combining trips. Avoid that every city has his own systems	Low cost participation
Ufemat & European contractors	Stimulate consolidated transports for different building sites.	Reduced number of transport movements into the city

Ufemat	Develop up-graded solutions for direct use supplied building materials (right place, right fit, right assembly) for new buildings as well as renovation projects. Self (un)loading devices, putting the right product on the right place in the building site.	Short delivery times, short building times
Ufemat & European contractors	Create more open and transparent communication facilities for the collaborated planning of building projects	Joined logistic efforts, more rational building methods
Producers & merchants	Be an expert in CAD CAM, be a partner. Demonstrate that you can	

	deliver to the lowest integral costs. Do find consolidation partners	
Contractors	Select your partners on lowest integral costs, instead of lowest price	

DON'T		
Actor	NOT to do	Result
Contractors	Use a large number of suppliers to innercity building sites	



Fig. 39: Prefab methods speed up building process

5. Conclusions

Only good entrepreneurs will survive in the logistic competition

1. Building materials are significant for cities

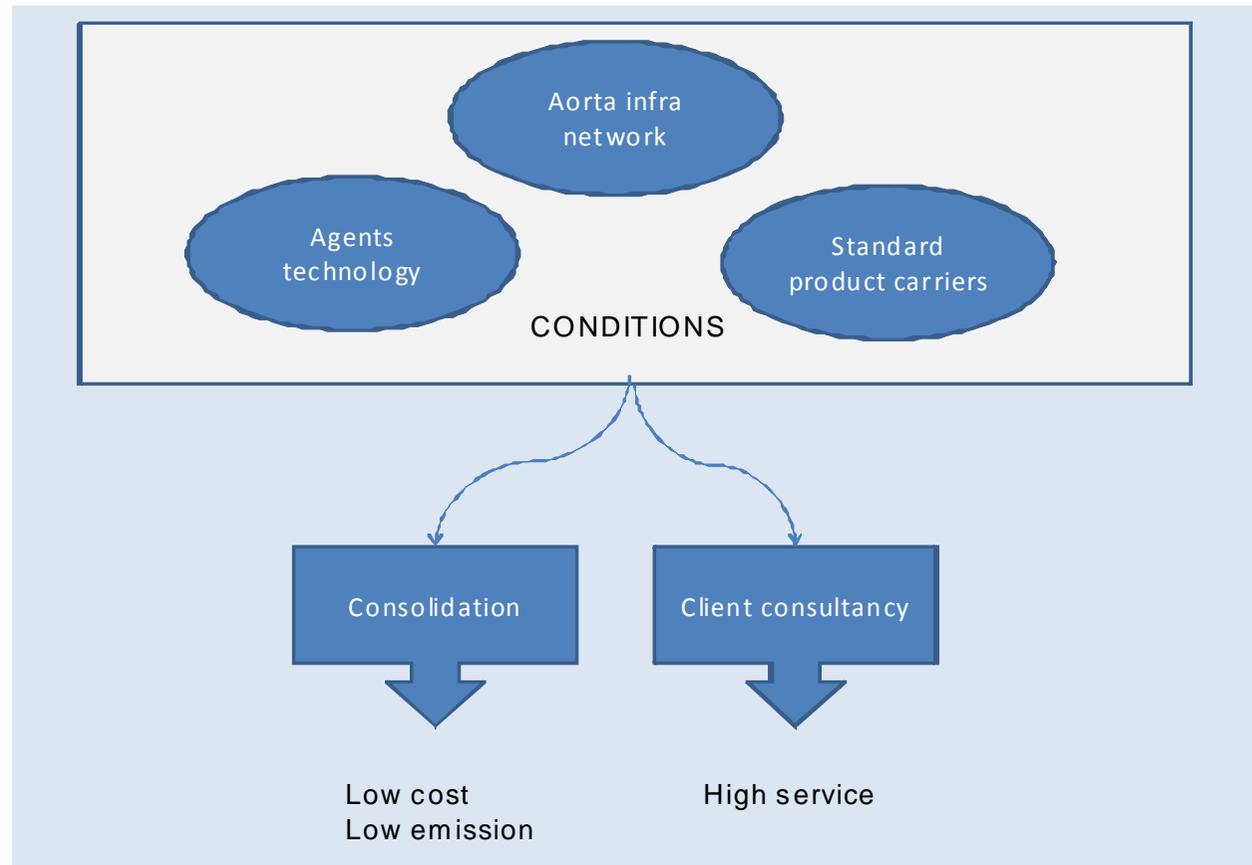
Building materials are a significant component of innercity freight logistics (ca. 15%). City authorities in many European cities as well as business players are heavily concerned about logistic bottlenecks and regulations. Logistic costs will rise essentially, coming years. There is clearly a growing urge for innovative logistic approaches.

2. Who starts the public-private dialogue? It takes two to tango.

Every city has to do with its specific situation. Only a public-business dialogue will lead to real step changes. Just waiting leads to further heart attacks. It's no use to wait for the first steps of the public authorities. It's relevant to find solutions with combined interest from city authorities and business players from building industry.

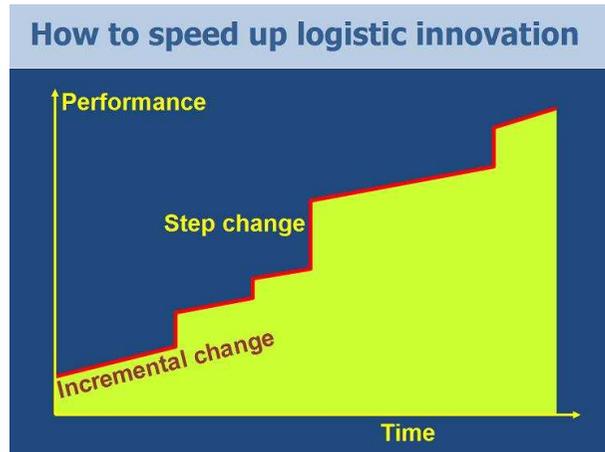
3. Mix of solutions required: policy – logistics – technology

Experiences show that only a mix of solutions (policy – logistics – technology) will lead to real breakthrough.



4. Challenge! Create space for innovations and experiments

Innovation is the result of challenge and ambition. Express ambitions in concrete challenges, and create step changes.



Most of these concepts (multi modal concepts, city box, agents) should be activated by city authorities as well as business actors. Most solutions require a certain scale to be economically interesting. And they require conditions (financial, space, etc.). So it takes two to tango. Best practices of dialogue and coinvestment should be communicated in EU.

5. Standardized solutions

Standardizes solutions will speed up the adaption of new solutions. Standardized product carriers,

standardized Just in time systems, standardised ICT, and probably standardized regulations.

6. Add value or shut down your company!

Sustainability and low-emission-logistics will be part of the game. If your company is not well equipped for these new challenges, it probably will not survive! Sustainable logistics will be required, or will be a commercial competition element. If you don't have enough scale of logistics, than better collaborate with professional logistic service providers, that have cleaner cars and more intelligent ICT.

If merchants of building materials are not able to compete on low cost logistics, they can choose for more intensive client relations. Therefore they have to create new services, and have to communicate with their clients on an professionalized level.

7. Create public-private fast learning networks

Experiments and innovations in different European counties should be connected, in order to speed up the innovation and the standardization process. All cities and all entrepreneurs should know what has been invented in other European areas, not only on technical issues, but also on financial and regulations issues. Availability of these networks will speed up innovation.

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