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Executive Summary

Considering the needs for a better understanding, an optimised planning and an increased use of inter-modal freight transport on the one hand and the fundamental information deficiencies on the other hand, the INFREDAT project aims at developing a consistent methodology for collecting inter-modal freight transport data.

The availability of more and better information to the users is important in order to assess the advantages and disadvantages of inter-modal transport and to compare it with the competing modes. In addition, actors involved in inter-modal freight transport need this information, in order to optimise the functioning of the inter-modal transport chains.

In this context, the INFREDAT project results provide answers to the following questions:

- Which groups of professionals are interested in inter-modal freight transport?
- What data is required by each user group that correspond to their interests? With what frequency?
- What should be the structure of inter-modal freight transport data?
- Which are the existing sources of inter-modal freight data and which are additional ones?
- Which of the data / information is available?
- Which model(s) is (are) required for the estimation of missing data and the forecast of future data?
- How can the information and data be collected?
- What are the costs and benefits of the approach chosen?

As a specific horizontal activity, complementary to the conceptual project work, three pilot case studies are used to analyse practical experiences in collecting inter-modal freight transport data. As a second accompanying measure, an Advisory Committee is formed by bringing together representatives of different relevant user groups both from transport industry and from the policy side.

In summary, the results of the INFREDAT project provide a comprehensive insight in the present data needs and data availability in the context of inter-modal freight transport, considering also possible future data sources and IT-based data collection methodologies. It was found out that the information currently available in the field of inter-modal flow data remains poor and fragmented. There are detailed but dispersed data about nodes and links, but only on a mode by mode basis. No data base exists at the European level that is based on a real inter-modal approach.

The main elements of the 'data collection methodology' are the description of how a complete data base structure has to be defined and a data model for the estimation and forecast of missing or future data need to be developed, and – in concrete – which data have to be collected, and how to fill the data base structure proposed. On the basis of a cost/benefit – cost/effectiveness analysis, the collection methods are ranked according to their cost/effectiveness ratio and recommendations for the sequence of implementation of different collection methods are given.

Further relevant findings could be identified with the help of the pilot case studies and in discussions with the members of the Advisory Committee.

The aim of the Final Report is to describe and to summarise the results of the INFREDAT project and to conclude on the recommendations on the basis of the project work. The INFREDAT project, especially with respect to the elaboration on the data base structure, the data model, and the data collection, gives particular prominence to the 'Public Sector', especially the European Commission, Eurostat, and the national governments, identified as the main user group of the INFREDAT project results.

The final recommendation is not to develop different scenarios for the collection process but to provide a system of methodologies that come up to the data users' expectations. The most important data users will be the 'Public Sector'. Therefore the collection approach must suit the data needs of these users.

The appropriate data collection method is defined in form of a Basic Scenario. The Surveys and Counts Scenario is a supplement to the Basic Scenario in order to improve the data and to recalibrate the parameters and models due to time dependent structural changes. Both Basic Scenario and Surveys and Counts, which together perform a method for permanent data collection, need a well defined organisation of data collection and data processing. It is recommended that the responsibility for the organisation and data processing lies on the Public Sector and it has to be centralised.

In future, advanced IT solutions such as Tracking and Tracing (T&T) or EDI might be used first to complete and in long term possibly to replace some of the collection methods identified. Today, T&T only provides a specific view of inter-modal transport data which is not sufficient for the INFREDAT data base.

The most realistic (and recommended) approach suggested by the results of the cost-effectiveness analysis is to follow a gradual path of implementation, in which a first step is devoted to develop and consolidate the modules of the basic scenario (statistical and other sources), and a second step adds systematic sample surveys and counts to further consolidate the data base every 3 years.

In continuation of the INFREDAT project and on the basis of its results, the actual realisation of the proposed methodology is required. Here, the willingness of transport market actors to contribute to the building of an inter-modal freight data base and, closely related to this, the issue of data confidentiality or, in other words, the breaking point for the operators to support the data collection, will be key for the success of the realisation of the data collection approach. These aspects needs to be solved with highest priority.

1 Objectives of the project

Inter-modal freight transport has received significant political attention during the recent years and is of priority for decision-makers at both national and European level. In COM(97) 243[1] is stated:

> *"…In order to improve the basis of transport policy measures in a competitive market, inter-modal statistics which can provide details on the volume and structure of transport flows are needed. Data on the transport modes and loading units used, on the types of goods transported and on the other quality parameters of transport is required in order to allow a comparison to be made with uni-modal transport. The organisation of inter-modal statistics in some countries shows that shippers as well as transport operators can be direct suppliers of relevant data, and that data collection can be organised by private organisations on a self-supporting basis. In order to collect the relevant information in a cost-effective way, the future system should be based on sample services, complemented by information from modal statistics and traffic counts…"*

On the other hand, in reality, three main factors have a significant negative impact on the availability of inter-modal transport data at the European level:

- Increasing competition and deregulation, making data more and more strategically important, and so confidential.
- The decrease in quantity and quality of data collected by customs.
- The reduction of budgets allocated to statistical data collection in the Member States.

Considering the needs for a better understanding, an optimised planning and an increased use of inter-modal freight transport on the one hand and the fundamental information deficiencies on the other hand, INFREDAT project aims at developing a consistent methodology for collecting inter-modal freight transport data.

The provision of specific information is extremely important for the decision-making of actors involved in the transport and logistics activities. The revolution in information technology provides the opportunity for logistics companies to utilise transaction-based and decision support systems to decrease cost and increase operating efficiency in this highly competitive market. The objective of the EU as far as transport systems and their efficiency is concerned, as stated in COM (97) 243, is to:

> *"…develop a framework for an optimal integration of different modes so as to enable an efficient and cost-effective use of the transport system through seamless, customer-oriented door-to-door services whilst favouring competition between transport operators".*

[1] Commission of the European Communities: "Intermodality and Inter-modal Freight Transport in the European Union", COM(97)243, Brussels, 29.05.1997

The availability of complete information to the users is important in order to assess the advantages and disadvantages of inter-modal transport and to compare it with the competing modes. In addition, actors involved in inter-modal freight transport need this information, in order to optimise the functioning of the inter-modal transport chains.

In this context, the INFREDAT project results give answers to the following questions:

- Which groups of professionals are interested in inter-modal freight transport?
- What data is required by each user group that correspond to their interests? At what frequency?
- What should be the structure of an inter-modal freight transport data?
- Which are existing sources of inter-modal freight data and which are additional ones?
- Which of the data / information is available?
- Which model(s) is (are) required for estimation of data gaps and forecast of future data?
- How can the information and data be collected?
- What are the costs and benefits of the approach chosen?

2 Means used to achieve the objectives

The INFREDAT project was carried out between December 1998 and March 2000. Several Progress Meetings on project level and working meetings on work package level took place. The Final Meeting including the presentation of results was held on 29. February 1999 in Brussels.

To achieve the project objectives, INFREDAT was composed of seven content related work packages:

WP 1 Framework of the analysis
WP 2 Review on existing inter-modal freight transport data and methodologies
WP 3 Elaboration of data model and data base structure
WP 4 Approach for data collection
WP 5 Cost-benefit analysis
WP 6 Pilot case studies
WP 7 Dissemination, recommendations & conclusions

As a specific horizontal activity, complementary to all other work packages, three pilot case studies were used to obtain practical experiences in collecting inter-modal freight transport data. Modelling of transport chains was tested in order to demonstrate how to fill the gaps between data available and data needed. Specific aspects such as confidentiality of data, mid and long term availability of the sources of information, or commercial interests of the data providers were investigated in detail. Each pilot study reflects a specific logistical context: new cars and car parts between Spain and Germany, 'white products' (washing machines, refrigerators, etc.) between Italy and the UK, and total goods between The Netherlands and Poland. For each pilot study, the feasibility of data collection was based upon a limited number of interviews with key economic actors (operators, shippers, forwarders, etc.) in order to involve them as much as possible in the analysis of all technical, organisational, economic, and strategic aspects of inter-modal data collection.

As a second accompanying measure, INFREDAT formed an Advisory Committee (AC) by bringing together representatives of different relevant user groups both from transport industry and from the policy side. The members of the AC provided specialist advice to the project, and in particular to work package leaders, to ensure the practical relevance of the work package outcomes and the possibility to use the results in a future day-to-day environment.

To perform this task, the representatives of the AC were asked to participate in three workshops. Additionally, individual members of the AC were asked to give advice to specific items related to their individual knowledge and experience. During the project lifetime three joint workshops of the AC and the project partners took place in Brussels. They were held on 16. March 1999, 29. October 1999 and 29. February 2000.

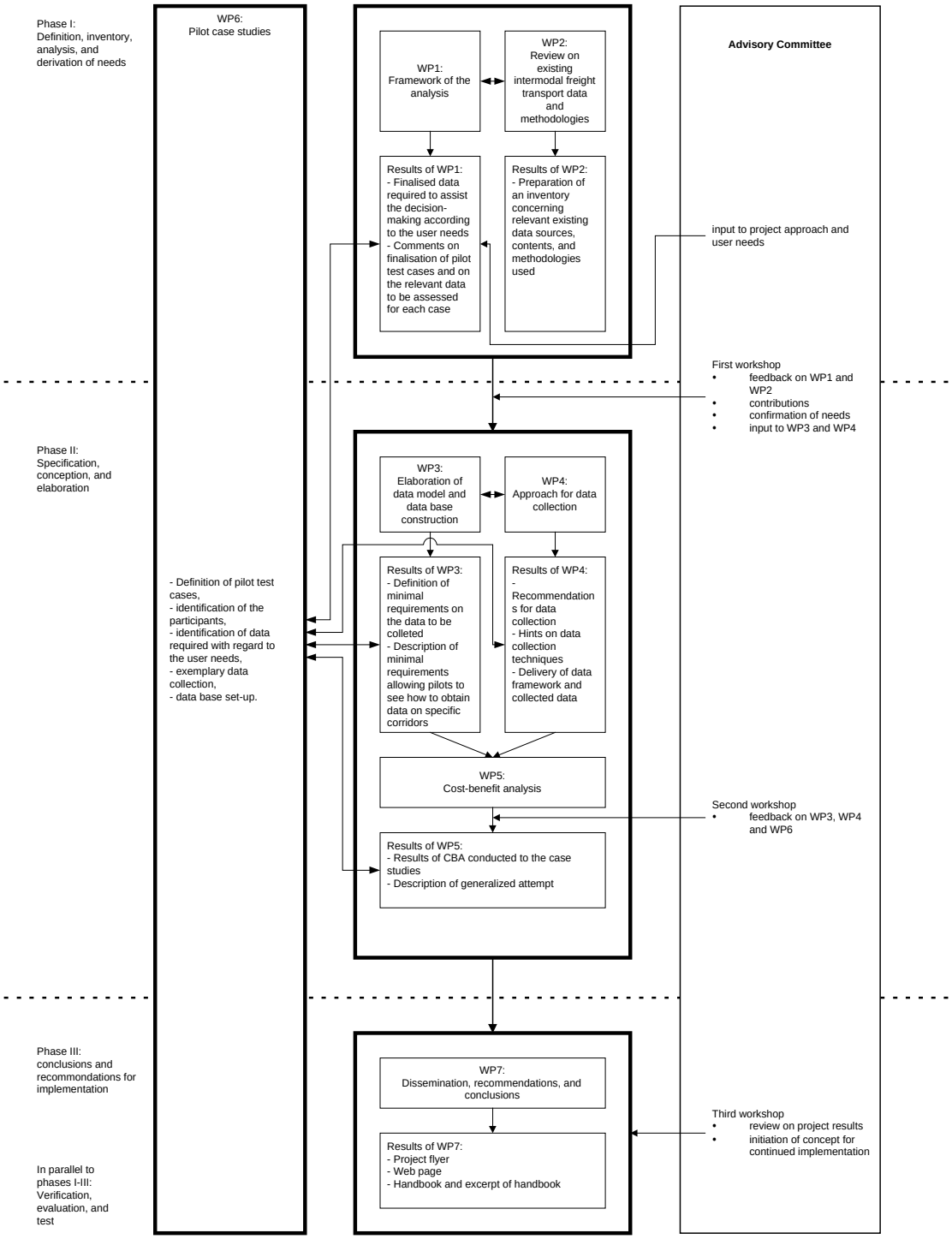
From consortium side, the AC was appraised as potential starting point for further joint activities of relevant actors in the inter-modal transport market, which have been brought together within this project as a first step. However, future common activities of AC representatives cannot be developed after the project finalisation.

For information and to initiate further discussions, an internet web-page, which was used as project home-page and a discussion forum on these pages, was created. The intention of the home-page was to inform every potential web-user about the project, but in particular it was meant to inform persons in detail about the project who had seen the INFREDAT flyer, or knew of the page through an announcement of one of the workshops, or the article on the EIA (European Intermodal Association) web-page. The intention of the discussion forum was to stimulate the exchange of opinions and information between persons involved in the project and project related persons and those outside the project.

In addition to the results and conclusions presented within the Final Report, several documents were produced describing the project findings. All publications are listed in the annex.

The correlation between the different work packages is presented in the following figure.

Figure 2-1: Input – Output relationships of work packages and activities



3 Scientific and technical description of the project

The scientific and technical description of the INFREDAT project within this chapter follows broadly the structure of the seven content related work packages.

Within chapter 3.1, the project framework and the definition of inter-modal transport used are set. The relevant user groups and their data needs are investigated.

Within chapter 3.2, a review on existing inter-modal freight transport data and their sources is given. Also former projects relevant in the context of INFREDAT are listed.

Chapter 3.3 mainly reflects the findings of the three pilot case studies describing the most suitable additional data sources and data providers. For each relevant data item, the most appropriate data provider has been identified. A combination of the interview results and expert knowledge provides an outlook to possible data sources due to the use of advanced information technology within five years.

Chapter 3.4 describes the structure of an inter-modal freight transport data base following the approach of an inter-modal transport chain. Using this structure, any transport chain but also uni-modal transport activities can be described.

The role of modelling to estimate and forecast data that cannot be collected directly, some existing data models and the framework for an INFREDAT estimation model are described within chapter 3.5. Further an example for the application of the INFREDAT estimation model is given on the basis of the pilot case The Netherlands-Poland.

Within chapter 3.6, the complete set of data to be collected to fill the data base structure defined in chapter 3.4 is defined. Specific, flexible data collection scenarios are designed to gather these data. Here also limitations and possible problems to be encountered are discussed.

Within chapter 3.7, the evaluation methodology elaborated within INFREDAT is described in short and a cost/effectiveness, cost/benefit analysis of the three scenarios described in chapter 3.6 is examined. The results of this analysis provides the basis for recommendations for the order of data collection methods to be applied.

Chapter 3.8 briefly summarises the dissemination activities undertaken within INFREDAT.

The main results are summarised and recommendations are given in chapter 4.

3.1 Framework of the analysis

3.1.1 Definition of inter-modal freight transport

There is no generally accepted definition of the terms inter-modal or combined transport, but there is a consensus that inter-modal transport constitutes a transport process in which at least the two following conditions are fulfilled:

- At least two different transport modes (truck, train, barge, vessel and aircraft) are involved.
- The goods remain in one and the same transport loading unit for the entire journey.

These conditions are in accordance with the definition adopted at the European Transport Ministers Conference (ECMT) of 1993 and also with the definitions adopted by the EU. There, first **multi-modal transport** is defined as:

> *"the transport of goods by at least two different transport modes".*

A subset of this is **inter-modal transport**:

> *"the transport of goods in one and the same load unit by various transport modes, whereby a change in the load unit does not entail a transfer of the transported goods themselves. The load unit can be either a vehicle or an inter-modal transport unit".*

Combined transport is understood as a subset of inter-modal transport, namely as:

> *"Inter-modal Transport in Europe, in which the larger part of the distance travelled is undertaken by rail, by barge or by ship and the pre-haul and end-haul by road is kept as short as possible".*

The European Union provides a more restricted definition. In this case, 'Combined Transport' is defined as:

> *"This means the transport of goods between Member States where the vehicle uses the road on the initial or final leg of the journey and, on the other leg, rail or inland waterway or maritime services where this section exceeds 100km as the crow flies…".*

In the context of INFREDAT, inter-modal transport has the following definition:

Inter-modal transport is the movement of goods in one loading unit, which uses successively several modes of transport without handling of the goods themselves in transhipment between the modes.

This definition implies three conditions:

1. Two or more different transport modes are deployed.
2. The goods remain in one and the same transport loading unit for the entire journey. Transport loading units refer (amongst others) to containers, swap-bodies and semi-trailers.
3. When inter-modal transport is used by rail or water, it replaces potential long-distance transport by road. Road transport is deployed for local distribution.

While the definition of inter-modal transport sets-up the frame for the INFREDAT work, the potential of multi-modal transport is not neglected and is considered when defining the INFREDAT data model.

3.1.2 User groups and data needs

The identification of the groups of professionals involved in inter-modal transport is essential in order to define the exact data elements needed to be collected. Some of these data elements are common to all of the groups and, of course, others are needed more by some of them. The individual needs of each of these groups depend on their area of operations and therefore their special interests.

There are three main groups of inter-modal transport data users that are considered in the context of INFREDAT:

- Policy makers
- Transport market actors
- Transport planners (excluding policy-makers)

3.1.2.1 Policy Makers

The main objective of policy makers, like the European Commission and governments, is to improve interoperability and to reduce the costs of inter-modal transport by providing a policy framework for an optimal integration between transport modes. More specifically, in COM(97)243, the European Commission states that

> *"… the objective is to develop a framework for an optimal integration of different modes so as to enable an efficient and cost-effective use of the transport system through seamless, customer-oriented door-to-door services whilst favouring competition between transport operators".*

This group of transport market actors needs inter-modal data in order to develop policies to encourage appropriate modal choices to achieve a sustainable and balanced use of the transport network.

Policy-makers mainly need information related to total annual volumes transported broken down by:

- Transport routes (corridor, network segment, transport chain)
- Modes involved in the door-to-door transport chain (rail, road, maritime, inland waterways, air)
- Type of loading units (container, Swap-body, trailer)
- Commodity groups (information on the kind of products transported)
- Trip distances (in km)
- Cost components / Transport prices (in Euro)
- Value of shipments (in Euro)

3.1.2.2 Transport Market Actors

The following transport market actors needs resulted from the interviews carried out. Transport market actors are closely related to the actual transport and every-day operations and as such they are directly affected by the type of market segment they serve for their needs.

Railway operators and ports

According to the interviews carried out, the following main data needs were mentioned:

- First origin – final destination of goods
- Identification of the shippers
- Region to country flows, by mode
- For ports: inland mode of transport

These actors are very sensitive to the decrease of statistical data in quality and quantity. Indeed, they provide already statistical data to national statistical offices, and they are part of the current data collection process at the level of each member state. They also provide aggregated data, but they know only a part of the total transport chain.

The lack of reliable, frequently updated flow data by origin-destination at a sufficient level of detail (NUTS 2 or NUTS 3) appears as the most crucial need for companies interviewed. Conversely, they master rather well data dealing with infrastructure and services.

Shippers, road transport operators and infrastructure operators

The shippers generally have the data they need for the organisation of their operations (prices, delay, quality).

According to the interviews, the suppliers and transport operators need in priority operational data, being **updated every day** at **shipment level** and for each segment of the supply chain.

They want to be able to:

- follow each individual shipment;
- have all the necessary data to react in real time to optimise their transport / logistic organisation, in particular in the case of unexpected events, for example the availability of handling equipment at a given time for a given transhipment point;
- choose the most profitable transport and logistical options.

For the shippers according to the interviews, all data are useful as soon as they are frequently up-dated, sufficiently desegregated, and reliable (quality control of the data collected). Moreover, half of them express some concern about the decrease in quality and quantity of data.

For the transport operators, the main needs are the detailed flows by type of commodity from region to country, the identification of shippers which operate on a given region to country axis, the names and characteristics of the inter-modal equipment / facilities, operators and the breakdown of flows by modes on a given region to country axis.

In more detail, the main data needs, specific for transport market actors, are related to factors time, quality (reliability and accessibility) and cost can be listed as follows:

Time: Schedules, transport times, delays, frequency of services (transport services), bottlenecks, cut-off time, slot availability (also transfer points)

Quality: Terminal and transport mode access, capacities, accidents and damages, available facilities, handling equipment, opening times, product range handled, information systems, specialised storage

Cost: Transport costs, distances, prices, materials and labour costs (transfer points)

The majority of shippers and transport operators consider that the data / information available through their suppliers and clients about shipments is sufficient to run their businesses. They also feel that these data are enough to evaluate their market share and for financial planning. The priority for data is to be updated daily, preferably at shipment level and for each segment of the supply chain.

Conversely, ports and institutional bodies, which already provide some statistical data, consider the lack of data as a crucial problem.

3.1.2.3 Transport Planners (excluding policy makers)

This more scientific group is interested in various data about the whole transport chain of inter-modal transport, in order to be able to describe structures of different modes within the transport market. Thus, such data are related to modes and their relation for specific commodity types, for each part of the transport chain, transport and transhipment cost, transport volume, qualitative aspects of the transport, etc.

Detail of information

The identification of types of data needed must consider particular needs of the different user groups, since they will assist for taking decisions of different nature by them. For example, transport market actors need complete information at operational level, in order to choose the most appropriate components of a transport chain. In contrary, policy makers and transport planners need information at a 'macro' level (as results). This information must be easy to be handled and processed, in order to be able to assess the impact of new policy measures, or to identify and plan priority transport projects in the future.

The following table provides a presentation of detailed types of data needed per user group.

Table 3-1: Data priorities per user and data group

	DATA USER GROUPS		
DATA ELEMENTS	**POLICY MAKERS**	**TRANSPORT MARKET ACTORS**	**TRANSPORT PLANNERS**
NETWORKS			
FIRST PRIORITY	• Demand data • Bottlenecks (per mode) • Forecasted demand data • Environmental impacts • Accident data	• Demand data • Bottlenecks (per mode) • Infrastructure related data • Traffic data-volumes transported (for all types of loading units, commodity types, modes and for different time periods) • Transport times on the links • Forecasted demand data • Transport costs on the link (all modes)	• Transport times on the links • Transport costs on the link (all modes) • Time schedules • Prices • Delays
SECOND PRIORITY	• Transport costs • Infrastructure related data • Traffic data-volumes transported (for all types of loading units, commodity types, modes and for different time periods) • Delays	• Bottlenecks • Infrastructure • Capacity • Accident data • Distances • Type of link • Speeds	• Capacity considerations • Environmental impacts • Accident data • Time schedules • Distances (position in the network) • Type of link (classes) • Prices (of various services, usage, etc.) • Speeds • Delays

	DATA USER GROUPS		
DATA ELEMENTS	**POLICY MAKERS**	**TRANSPORT MARKET ACTORS**	**TRANSPORT PLANNERS**
TRANSFER POINTS			
FIRST PRIORITY	• Capacity data (handling, time period, type of loading unit, storage per type of loading unit and surface) • Environmental impact • Bottlenecks	• Demand data (volumes handled, stored) • Capacity data (handling, time period, type of loading unit, storage per type of loading unit and surface) • Access (road, rail) • Modes served • Available facilities • Accident / Damages data	• Capacity • Available facilities • Modes served • Access • Cut-off time • Time schedules • Specialised storage • Slot availability • Warehousing prices • Handling prices • Opening times • Handling equipment • Materials & labour costs
SECOND PRIORITY	• New technologies • Modes served • Access (road, rail)	• New technologies • Bottlenecks • Environmental impact • Accident data • Product range handled • Information systems • Auxiliary services • Regional policy • Land & buildings • Warehousing capacity	• Terminal equipment • Environmental impact • Bottlenecks • Accident / Damages data • Land and property acquisition costs • Area occupied • Materials and labour costs • New technologies (handling systems, information systems)

	DATA USER GROUPS		
DATA ELEMENTS	**POLICY MAKERS**	**TRANSPORT MARKET ACTORS**	**TRANSPORT PLANNERS**
TRANSPORT SERVICES			
FIRST PRIORITY		• Transport costs of each of the services offered • Warehousing capabilities (specialised services, eg refrigeration) • Handling systems • On-time delivery, price • Total time required for the overall process (an average figure)	• Transport costs • Handling systems • Frequency of services
SECOND PRIORITY	List of any additional services offered (except transhipment)	• Additional services • Warehousing capability • Terminal accessibility • Routing	Terminal / hub accessibility (indicators oftimes)

	DATA USER GROUPS		
DATA ELEMENTS	**POLICY MAKERS**	**TRANSPORT MARKET ACTORS**	**TRANSPORT PLANNERS**
ORDER DETAILS			
FIRST PRIORITY		Total annual volume transported by: • Commodity group • Size of shipment • Value of shipment • Trip distance • Type of loading unit (containers, swap-bodies, etc.) • Modes involved • Commodity types • Type of transport chain • Containerisation • Transport prices	• Size of shipment • Value of shipment • Loading unit type • Transport services • Damages factor • Order cycle time
SECOND PRIORITY	Total annual volume *	• Commodity type • Trip distance • Modes involved • Incoterms • Regional policy • Cost components	• Damages factor • Regional policy data • Land availability • Land prices

* Note: For demand purposes the volumes are based on the following elements, some of which might be useful for the policy-makers in assisting for specific elements of their decisions:

- Commodity group
- Size of shipment
- Value of shipment
- Trip distance
- Type of loading unit (containers, swap-bodies, etc.)
- Modes involved
- Commodity types (manufacturing goods, dangerous / hazardous materials, etc.)

There are many types of data, which seem to be different in the outset, but for which in fact there are many synergies especially during the collection process. Therefore, they need to be supplied all together to the potential user. For example, the availability of slots at a terminal is closely related to the types of loading units and the handling systems available at the specific terminals. Therefore, there is a need for uniformity and integration of existing data and for providing the data to the potential user of inter-modal transport in a consolidated form.

In the whole INFREDAT project, in particular with respect to the elaboration on the data base structure, the data model, and the data collection, particular prominence is given to the public sector as the main user group of the INFREDAT project results.

3.2 Review on existing inter-modal freight transport data

As a starting point for the realisation of the inventory of inter-modal sources, available input from specific projects performed during recent years, among which the APAS study 'Databases and Scenarios', the INFOSTAT project and the IMEG (Intermodal Expert Group), is used. Also the elaboration on the INFREDAT project framework has been taken into account.

In the context of the INFREDAT project, a grouping of data sources has been used as follows:

- **Primary sources** produce raw data (transport operators, shippers, forwarders).
- **Secondary sources** collect, harmonise and aggregate the data produced by primary sources (professional associations, statistical offices, ministries).
- **Tertiary sources** collect and process data available from primary and secondary sources.

Within INFREDAT, a detailed investigation of the above mentioned sources has been made. The findings are summarised in tabular form in the annex.

3.2.1 Inter-modal flow data

Four kinds of primary sources *manage and co-ordinate several segments of the transport chain* and are key contacts for a comprehensive information on inter-modal flows:

- Shippers
- Logistics operators
- Forwarders
- Maritime companies (when they perform door to door services, as 'carrier hauliers').

Maritime and inland waterway **port authorities** and **terminal operators** as well as rail terminal operators can also provide sometimes inter-modal information about at least two segments of the transport chain. Generally speaking, nodal point operators are key contacts in the provision of data. In addition to direct supply, they can also be a source of a sample of units in transit through the node.

Above mentioned sources generate more and more frequently inter-modal data dealing with each consignment (goods or containers according to the case) from their internal management systems, but they generally do not produce the corresponding aggregated statistics. Moreover, most of the time, the information is restricted to internal use.

Five primary sources may bring useful *information on the interface between the transport mode* they manage and the segment of the transport chain being immediately before or followed after:

- Inter-modal operators
- Railway carriers
- Road carriers
- Inland waterway carriers
- Air carriers

Attention should also be paid to the existence of Origins and Destinations (O&D) surveys. For example, the UK has conducted a number of surveys over the last ten to fifteen years in connection with the opening of the Channel Tunnel.

These surveys, based on the methodological input acquired with research projects as COST 312 'Evaluation of the effects of the cross-Channel fixed link on traffic flows', are a valuable tool in the identification of some aspects of transport chains (if the surveys can be conducted reliably) as well as a valuable data source against which modellers can calibrate the performance of their models.

As a whole, the information currently available in the field of inter-modal flow data remains poor and fragmented. Most statistics available deal only with containerised data and combined transport.

3.2.2 Inter-modal infrastructure data

The main primary sources of infrastructure related information are:

- the nodal point operators, and
- some European RTD projects focusing on inter-modal infrastructure, mainly IQ and IMPULSE.

Inter-modal data available concern the access / egress to / from nodal points (modal infrastructure linking the node with transport networks), the handling equipment and its characteristics.

There is no detailed and regularly updated source of information on the inter-modal infrastructure network and corresponding mobile equipment at the European level. Specific studies have been carried out, but none of them allows to follow the time evolution of this infrastructure. The output of the project IMPULSE has strongly contributed to improve the quality of the information available.

There are detailed but dispersed data about nodes and links, but only on a mode by mode basis. No data base exist at the European level being based on real inter-modal approach describing links between modes as well as 'virtual links' within each nodal point.

3.2.3 Inter-modal service data

Details on inter-modal service offers are published mainly by the inter-modal operators themselves for commercial purposes. The kind of information made available and the way of publishing them is manifold, e.g. information on request by phone, brochures or leaflets, or time schedules on the internet.

Possibly relevant projects for further consideration are CESAR (II) and INTRARTIP, both providing operational systems for (pre-)booking operations, and hence offering specific information on the inter-modal services included in the systems.

Some data bases provide more or less detailed inter-modal services data. However, they are limited by the fact that operators, prices, capacity, and frequencies change frequently.

3.2.4 Professional associations

Professional associations (e.g. UIC, UIRR, ICF) can provide transport data. However, it is collected from members on a voluntary basis and only part of it is publicly available. The data collected is generally uni-modal data:

- There is no follow-up of the transport chain as a whole.
- Pre- and end-haulage modes of transport are not known.
- When the number of containers is available, the content of the container is not known.

3.2.5 Results from former research projects

Apart from data available from international organisations and associations, research projects funded by the European Commission are also offering plenty of information on inter-modal transport infrastructure and operations.

INFOSTAT: Information on the existence of data bases at national level; framework for the introduction of a European Transport Policy Information System (ETIS).

Euroterm: Information about 370 European terminals in 22 countries in the EU and Eastern Europe.

APAS: Information on inter-modal terminal users, on terminal owners and operators and on actors in the macro-socio-economic context (e.g. government).

Survey of European Intermodal Association: Information on minimum standards at terminals and general information on the terminal organisation and management.

Impulse: Information on 200 terminals (public and private), 250 European freight links and more specific information on their location, capacity, equipment and traffic.

Simet: Modelling exercise and development of a data base consisting of 16,000 nodes with their geographic co-ordinates, type, total traffic volume and 2,500 links.

IQ: Data base with European physical networks (road, rail, inter-modal terminal characteristics) and for freight traffic flows (sea, rail-road and combined); terminal data base on physical aspects, management aspects, activities of the terminals, logistics services offered, performance indicators and description of investments made; traffic data base containing transport flows between regions (mostly NUTS-II for the EU member countries).

OD-ESTIM: Methods for the estimation of transport flows between regions using regional socio-economic information.

ASSEMBLING: Establishment of a European network of monitoring centres for transport infrastructure; methodology for establishing general data bases on transport flows, infrastructure networks and socio-economic data.

MYSTIC: Survey of shippers; collection of transport chain data for France, UK and Benelux; methodology to trace the transport chain from origin to destination.

OSIRIS: Survey among 26 transport market representatives throughout Europe has been undertaken in order to investigate the inter-modal transport market; demand for seaport hinterland container movements referring to 1995 and 2000.

STEMM: Surveys on transport chains for passenger and freight transport between the UK and Continental Europe.

Other sources of inter-modal statistics are the following:

Planfreight: (AND) Data base on terminals and network services consisting of 1,100 terminals, all transport links in Europe (15,000 routes) and company address data base (1,000 addresses); general information on the terminals, on served modes and loading units, on terminal equipment.

NEAC data base: (NEA) Commercial data base on inter-modal transport chains in Europe containing trade flows through available national and international data bases and regional data from available international region-to-country to region-to-region data.

Study of European Inland Container Traffic: (MDS Transmodal) Data for 1982, 1986, 1992 and 1996 on the structure and mechanism of the inland distribution of maritime containers within Europe.

Union's Territorial Strategy (UTS) study: Location of main transhipment points in Europe, with data on transfer times and waiting times, modelling of travel times and transport costs for the main European axes.

IMEG: (Eurostat, 1998) Preparation of a detailed framework for the elaboration of a set of reliable inter-modal statistics by Eurostat on the medium term (year 2002); statistical data on inter-modal transport based on rail, combined and maritime transport, as well as ports data and also statistics based on a transport chain (Catalunya-Ruhr district).

'Inter-modal freight transport – Key statistical data': (Eurostat, 1999) A meta-data base on inter-modal transport in Europe was developed 1998/1999.

'Development of Inter-modal (Freight) Transport Studies': (Eurostat, 2000) This project mainly aims at four targets: i) a formally specification of information needs, ii) to establish a manual on techniques for valorisation of existing available data, and to enable specification to collect further information, iii) to assist Eurostat with IMEG and the Working Group on Intermodal Statistics, iv) to assist Eurostat in up-dating inter-modal statistics publications.

Available information as a whole is seen as being rather scarce and fragmented. In particular, infrastructure data mainly concerns networks and nodal points, like logistics platforms, statistics, or ports. They mention the existence of detailed data about nodes and links, but on a modal basis. As far as goods transport flows is concerned, the data available refers mostly to combined transport rather than inter-modal and there are no regularly updated statistics on transport or supply chains.

3.3 Additional data sources and data providers – Results from three pilot cases

The idea of investigation three pilot cases was to identify the most relevant sources and actors being potential providers of inter-modal data, to assess the feasibility of data collection

(barriers and opportunities) and to define the modelling requirements in order to 'fill the blanks'.

This assessment has been carried-out through three contrasted pilot cases:

- The traffic of new cars produced in Spain and transported to South Germany
- The traffic of white products from northern Italy to the United Kingdom
- The total traffic (all types of goods) between The Netherlands and Poland

Each pilot case contained the collection of relevant macro-economic data, the selection and interviews of key professional players and finally a synthesis including the build-up of a preliminary set of qualitative and quantitative data. A total of 44 in-depth direct interviews was carried-out among shippers, forwarders, transport operators, ports, …. Each company manager and / or the responsible logistics manager was interviewed on points dealing with the organisation of transport in his company, his interest in each pilot case, and with the limits to be taken into account concerning access to internal data. These contacts have also allowed to identify the degree of interest of the companies in the issues dealing with the INFREDAT project, and their possible involvement in such a project.

Because of the close relation between the issues analysed in the context of the three pilot cases and the contents of the other work packages, the results of these investigations are separated and presented in the context of the following chapters.

3.3.1 Inter-modal transport within EC borders

Operators and shippers are conscious of the decrease in quality and quantity of publicly available statistical data. They agree that there is a mutual interest in improving statistics. To the question *"Would you be ready to be involved in a future data collection process?",* 41% of the interviewees answered positively. But only 25% of the shippers and 33% of the forwarders interviewed, those parties which possess most of the relevant data, indicated a willingness to participate.

Shippers and road hauliers are more hesitant about being involved in data collection. They believe that the data they have is sufficient and they do not want to incur extra cost for producing statistics.

Port operators are already data providers, even if the data are relatively limited: tonnage by type of goods, by overseas origins and destinations, containerised traffic, and sometimes the in-land traffic by mode.

Airports publish their incoming and out-going tonnage per year. They are ready to participate in a data collection process.

The views of railways is more ambiguous. They already provide data to public authorities, but because of the fierce international competition the quantity and level of detail of data provided is decreasing.

The different transport actors have generally only part of the information concerning the whole transport chain. To the question *"About which part of the chain is data existing in your company?"*, only 36% of the interviewees are able to identify the single transport unit all along the chain of transport. Considering only the forwarders, 50% have door-to-door information and 50% have partial information.

Comprehensive data collection would involve all types of actor, as each can supply information on different aspects of freight flows, but mainly shippers and forwarders:

1. shippers — transport chain structure and flows
2. forwarders — transport services and inter-modal chain performances
3. transport operators — basic network
4. nodal point operators — transfer points

Data availability by profile of player in the transport chain is different with respect to the nature of data. Conclusions that could be drawn from the three pilot cases investigated are summarised as follows:

- Data concerning physical characteristics of the network (links and nodes) is not confidential. Main sources are the operators managing these infrastructures, and existing public data bases. Some research activities of the 4th Framework Programme provide detailed data.
- Flow data at detailed level are generally confidential. The behaviour of the players in terms of data confidentiality and of degree of aggregation of the data they are ready to provide is different according to their profile, even within the same category of activity. The pilots have also shown that this 'behaviour' depends to some extent on the type of goods considered.

  But whatever the source considered the information is available at aggregated level. The most relevant sources are:

  - Shippers when the market is oligopolistic, e.g. cars
  - Forwarders when the market is manifold
  - Nodal points for flows, irrespective of commodities

- When goods are transported in loading units, e.g. white products, the majority of actors of the transport chain do not know the type of goods transported (even at aggregated level). For cars, for instance, each actor of the chain knows the nature of commodity. In both cases, the most relevant source is the shipper.
- Value of products transported is considered as confidential when the commodity is clearly identified, e.g. cars or white products, but it can be available at aggregated level when different commodities are given together.
- Transport cost and to a less extent transport time data are part of the market offer of the players. Actual prices are always confidential.

The main factors limiting data availability are the heterogeneity of information systems at company level - 60% of interviewees have an in-house system -, conceptual factors linked to definitions and units used, and confidentiality factors.

Consultants experience from working on INFREDAT and other projects is that it is very difficult to collect information about prices in the transport market. In reality prices are the result of bilateral negotiations and are not published, except rail and ship official prices, though actual prices are generally different. Although the information about prices is essential, it has not been possible to identify any consistent issue for improving price data collection.

Attention has also to be paid to the format of data collected by shippers and transport operators. They collect information according to their own needs, and collected data differ

frequently from one player to another. These data are generally not directly usable for statistical purposes. Utilisation of these data assumes prior harmonisation of the information systems 'ex ante' through a common questionnaire for all players, or 'ex post' by harmonising the collected data.

The investigations and discussions with market representatives shows that, before extending the methodology for data collection, the problem of data confidentiality has to be tackled with priority. Although they are open to discussion, companies are reluctant to provide data because there is no 'official' and precise organisational framework guaranteeing this confidentiality.

3.3.2 Inter-modal transport crossing EC borders

Concerning transport chains crossing the EC border, e.g. with a destination in the CEEC, the main sources of information are official 'traditional' sources, mainly national statistical offices using customs figures. As long as customs exist, it is the more convenient source of information for commodity flows, for example origin and destination, commodity type and value, countries of transit, border points, etc.

Transport data is not always reliable, because the data is provided on a voluntary basis, and there is nothing about infrastructure and services registered by customs.

For transport data and services, transport operators are the most useful primary sources, except for costs which are confidential.

For infrastructure nodes and links, public data bases are good secondary sources. Otherwise, nodal point operators, including ports, provide useful detailed data.

3.3.3 Sources of data and information by variable and by profile of actor

The following tables (Table 3-2 toTable 3-8) summarise the data availability (or potentially available) by profile of actor in the transport chain, as a synthesis of the answers to the question *"About which part of the chain do you have data?".* The data which are not collected, because they are not useful to operators for their operational activity are indicated with a (-) in the table. The main source of information for a certain type of data / variable is market with an arrow (➔).

Table 3-2: Shippers

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	-	Pricing for use	Data about the basic network are not a priority for the shippers.
Transfer points	-	Pricing for use	Data about the transfer points are not a priority for the shippers.
Transport flows	Total annual flow by destination	By shipment*	From first origin to final destination; the mode is generally not known.
Trade flows	Total annual flow by destination	By shipment*	When only one commodity is concerned, e.g. cars, even the annual flow can be confidential.
Transport time	Annual average	By shipment*	Total time for final delivery
Inter-modal transport services	By shipment		
Inter-modal transport volumes	Total annual flow	By shipment*	
Transport chain structure	• Origin and destination • Number of loading units • Type of commodity • Weight of commodities	• Value of commodities • Total transport cost	For specific markets (cars, white products), data is known by shipment, except the number of loading units (annual). Shippers have no data on mode or points of transhipment.
Inter-modal transport performances	• Delay, • Accident by shipment	Special price conditions	The shippers collect the information which is useful for their activity. Inter-modal transport performances are generally collected 'ex post'.

This table concerns the shippers which organise the transport of the goods produced. If they do it, the 'forwarders' table is relevant.

* Detailed data related to one given shipment, e.g. origin, destination, nature of goods, weight, value, …

Table 3-3: Forwarders

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	• Link • Type of link at detailed level, distance • Speed, capacity (average)	Pricing for use	Data concerning the network are operational data for the forwarder who organises the transport.
Transfer points	• Position in the network • Volume transhipped at detailed level • Services • Capacity of transhipment or warehousing • Handling equipment or cut-off time at aggregated level	Transhipment cost	Data concerning the transfer points are operational data for the forwarder who organises the transport.
Transport flows	Total annual flow by destination	By shipment*	From first origin to final destination
Trade flows	Total annual flow by destination	By shipment*	
Transport time	Annual average	By shipment*	
Inter-modal transport services	At detailed level		
Inter-modal transport volumes	Total annual flow	By shipment*	
Transport chain structure	• Transfer points • Modes • Type of loading unit • Weight	First origin and final destination, nature of commodity, value, cost	The forwarder has to preserve a high level of confidentiality. If the shipper agrees, some confidential data can be available from the forwarder.
Inter-modal transport performances	• Delay • Accident by shipment	Special price conditions	This information is collected in anticipation, in order to be able to organise the chain of transport in the optimal manner.

*: Detailed data related to one given shipment, e.g. origin, destination, nature of goods, weight, value, …

Table 3-4: Transport operators

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	Detailed level, (including the price for using motorways or tunnels)	Price for use of the rail network	Transport operators need to have a good knowledge on the network in order to optimise their journeys.
Transfer points	Services, handling equipment		Knowledge is limited to elements useful for the transport operator (interface between link and platform).
Transport flows	Annual tonnage (average)	Tonnage by shipment	The transport operator does not know the flow by commodity, except for homogeneous shipment.
Trade flows	-	-	This variable is not so important for its day-to-day activity.
Transport time	Detailed level (for the part of the chain considered)		
Inter-modal transport services	Detailed level		
Inter-modal transport volumes	Annual tonnage	Transport cost	
Transport chain structure	• Detailed level (for the active and passive mode) • Type of loading unit (at aggregated level for the number of loading unit and the weight)		Information is limited to the part of the chain that the transport operator manages.
Inter-modal transport performances	• Detailed for bottlenecks • Average for rate of accidents	Special price conditions	

Table 3-5: Nodal point or port operators

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	Links (nature, type)		Physical details on links are not useful for nodal point operators
Transfer points	Detailed level, except volumes which are at aggregated level	Catchment area, transhipment cost	Tariffs are public, special conditions are not
Transport flows	Annual tonnage	By shipment*	
Trade flows	-		
Transport time	Average transfer time through the mode	Transfer time through the mode, by shipment	Nodal point operators have no information on the whole transport chain.
Inter-modal transport services	Aggregated level		Knowledge is limited to the interface nodal point – modes of transport.
Transport chain structure	• Active mode (when arriving at nodal point) • Annual number of loading units annual weight		The breakdown of the annual tonnage by commodity can be provided, except for loading units.
Inter-modal transport performances		Bottlenecks, special price conditions	This information is strategic.

*: Detailed data related to one given shipment, e.g. origin, destination, nature of goods, weight, value, …

Table 3-6: Aggregators (channel tunnel transport organisation, Italy – UK pilot case)

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	Detailed level (for all links connected with the Channel Tunnel)	Pricing for use	
Transfer points	Aggregated level	Transhipment cost	
Transport flows	Annual tonnage	By shipment* or by operator	
Trade flows	Annual tonnage	By shipment* or by operator	
Transport time	Average		
Inter-modal transport services	Aggregated level		
Inter-modal transport volumes	Aggregated level	Transport costs	
Transport chain structure	• Active mode • Passive mode • Annual number of loading units	Final destination (when the shipper can be identified)	The type of commodity in each container is not known.
Inter-modal transport performances	• Bottlenecks • Delay, accident	Special price conditions	The aggregator organises transport through the Tunnel. These performance data are elements of its strategy.

*: Detailed data related to one given shipment, e.g. origin, destination, nature of goods, weight, value, …

Table 3-7: EC Customs (NL – P pilot case)

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	-		No use
Transfer points	-		No use
Transport flows	Aggregated data		• Transport aspects are secondary for customs. • The reliability of data is low.
Trade flows	Aggregated data (yearly, monthly)	By shipment*	Customs are the best source of detailed data concerning trade flows.
Transport time	-	-	No use
Inter-modal transport services	-	-	No use
Inter-modal transport volumes	• Total annual volume • Total annual costs		The mode is given on a voluntary basis. This data is not exhaustive.
Transport chain structure	Border points		• These data are collected on a voluntary basis. • The result is not very reliable.
Inter-modal transport performances	-		No use

*: Detailed data related to one given shipment, e.g. origin, destination, nature of goods, weight, value, …

Table 3-8: Public data bases + EC studies

Variable fields	Variables available	Variables kept confidential	Comments (part of the chain concerned)
Basic network	Detailed level		Data bases exist in Europe, providing detailed descriptions of physical networks by single mode or for all modes.
Transfer points	Location		Studies of the 4th Framework Programme (example: IMPULSE)
Transport flows	Aggregated level, split by mode – NUTS 1 or 2 according to the country considered (annual)		Based on surveys, counts, and questionnaires on voluntary basis.
Trade flows	Aggregated level (annual)		Based on surveys, counts, questionnaires on voluntary basis, and customs.
Transport time	-	-	
Inter-modal transport services	-		Partial experiences have been done (IMPULSE, 4 FP)
Inter-modal transport volumes	Aggregated		Based on containerised flows.
Transport chain structure	Aggregated number of units, weight, main mode		Generally based on an O/D approach, considering only the main mode.
Inter-modal transport performances	-		

3.3.4 Future possibilities for data collection

The following tables illustrate the expected evolution of data availability in the next five years. It has been obtained by combining the interview results with the experience of the consultants working on the project. It is structured according to two main criteria; see legend at the bottom of tables: the origin of the information which is collected by each source indicated, e.g. transport documents, etc. and the method used to collect or transfer data from each source.

The main changes expected concerning data collection methods and sources are linked to new technologies, allowing real-time collection of data. It concerns mainly data relating to

- transport chain structure for each link of the chain and for the whole chain,
- inter-modal transport performances.

For other data, new technologies will allow the diversification of data collection methods. However, traditional methods, like analysis of statistical reports, of publications, use of internet or other relevant sources, surveys, interviews, traffic counts, etc. will continue to be essential.

Table 3-9: Medium-term evolution of sources and data collection methods

Data category	Attribute	Source	Information collected by the source*	Collection from sources**							
				Current				Future			
				A	B	C	D	A	B	C	D
Basic networks	1. Link 2. Type of link 3. Link class	Transport operators Link operators Data bases suppliers	Public data bases Internal data								
	4. Distance	Transport operators	Transport documents								
	5. Speed	Transport operators Shippers	Transport documents Receipts								
	6. Pricing for use	Forwarders Link operators	Transport documents Public data bases								
	7. Link capacity	Technical services within the ministries Link operators	Standards, norms Public data bases								
	8. Link characteristics	Link operators	Public data bases								
Transfer points	9. Relations / services offered	Nodal point operators, ports	Internal data								
	10. Additional services	Forwarders									
	11. Transport time	Forwarders Shippers	Transport document								
	12. Position in network	Nodal point operators, ports	Internal data								
	13. Transhipment volume		Internal statistics								
	14. Catchment area	Nodal point operators, ports	Internal data								
	15. Transhipment capacity										
	16. Warehousing capacity	Nodal point operators Storage agents									
	17. Handling equipment	Nodal point operators Handling agents, Stevedores									
	18. Cut-off time	Nodal point operators forwarders	Internal statistics								
	19. Transhipment costs	Nodal point operators forwarders	Transport documents Invoices								

* Information collected by the sources
- Transport documents (consignment notes, manifest, booking notes, receipts, delivery notes …)
- Invoices
- Commercial documents
- Internal data
- Internal statistics
- Public data bases

** Collection from sources:
- A = Analysis of statistical reports
- B = Analysis of publications, journals, internet, Web-sites, other relevant reports
- C = Surveys, interviews, traffic counting, etc …
- D = Constant collection of current data (new technologies)

Table 3-10: Medium-term evolution of sources and data collection methods (continued)

Data category	Attribute	Source	Information collected by the source *	Collection from sources**							
				Current				Future			
				A	B	C	D	A	B	C	D
Transport chain structures for each link of the chain	20. Origin / transhipment point	Forwarders	Transport documents								
	21. Transhipment point / destination	Forwarders									
	22. Active mode	Forwarders Transport operators	Transport document Booking notes								
	23. Passive mode										
	24. Number of loading units	Forwarders Shippers									
	25. Type of loading unit										
Transport chain structures for the whole chain	26. Commodity groups	Forwarders Shippers	Transport documents Booking notes								
	27. Hazardous / perishable	Forwarders Shippers Transport documents									
	28. Value	Forwarders Shippers	Transport document Booking notes								
	29. Total transport cost		Transport documents Invoices								
	30. Weight (gross / net)		Transport documents								
Inter-modal transport services	31. Relations / services offered	Forwarders Transport operators	Communication documents Internal data								
	32. Transport time	Forwarders Transport operators	Transport documents Proof of receipt								
Inter-modal transport volumes	33. Transport volumes	Forwarders shippers	Transport documents Booking notes Invoices								
	34. Transport cost										
Inter-modal transport performances	35. Bottlenecks	Forwarders Transport operators Link operators	Constant collection of data	Not collected							
	36. Delays / Punctuality indexes	Forwarders Transport operators		Not collected							
	37. Accidents	Forwarders Technical services within the ministries Transport operators									
	38. Special prices conditions	Forwarders Shippers		Not collected							

* Information collected by the sources

- Transport documents (consignment notes, manifest, booking notes, receipts, delivery notes …)
- Invoices
- Commercial documents
- Internal data
- Internal statistics
- Public data bases

** Collection from sources:

- A = Analysis of statistical reports
- B = Analysis of publications, journals, internet, Web-sites, other relevant reports
- C = Surveys, interviews, traffic counting, etc …
- D = Constant collection of current data (new technologies)

3.4 Structure of an inter-modal freight transport data base

The ideal data base

The first question to be answered is what the ideal transport chain information to be collected must consist of, while problems to collect the data are ignored. The focus is on possibilities and problems of construction and handling of the data base. Currently available data bases are partly a product of the technical possibilities of the past. Since the technical possibilities have improved, the ideas of whether it is possible to collect more complex data have to be revised.

Transport chain approach

A record structure that includes all relevant variables to follow the consignment from the place of production via transhipment locations to the place of consumption where several modes can be used can be called a 'transport chain' data base.

In the first place, the transport chain data base should be a simplification of reality in order to be able to understand how and where transport takes place. This means that many variables that could be observed have to be left out, since each analysis of a problem requires another level of detail of the data base.

The Record Structure

The record structure of the INFREDAT data base is described below. It is advisable to create one transport chain data base for commodities and loading units. For this data base an ideal record structure is now presented, which is flexible for the number of transhipment points to be included.

Table 3-11: Data record structure

Transport chain data base for commodities and loading units
• origin • active mode 1 • passive mode 1 • loading unit 1 • transhipment point 1 • active mode 2 • passive mode 2 • loading unit 2 • transhipment point 2 • . . . • . . . • . . . • . . . • active mode n • passive mode n • loading unit n • transhipment point n • destination • commodity • number of loading units • net weight • value

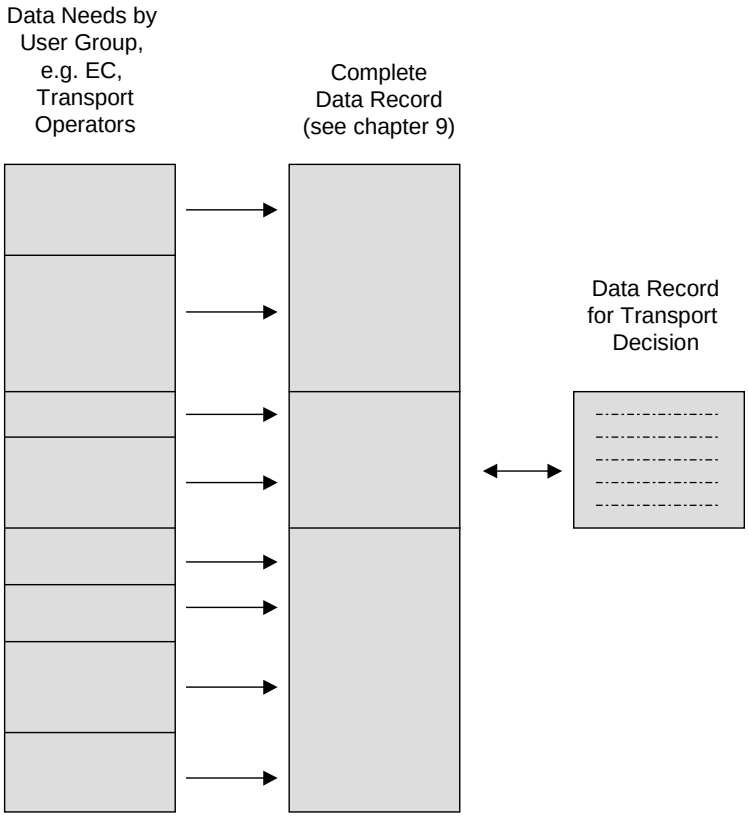
This record structure is an important result, which can be applied in all fields of transport for the description of transport flows. It must be observed that this record structure can handle all existing transport flows. So not only inter-modal but also uni-modal transport.

It should be noted that only dynamic data are considered. The more static data like:

- Transport costs
- Transport times
- Transport distances
- etc.

are stored separately with inter-linkages to this source. Static data are relatively rarely updated, while dynamic data are fast changing and require special methods of handling. In the following figure this is shown schematically.

Figure 3-1: Relation of record structure



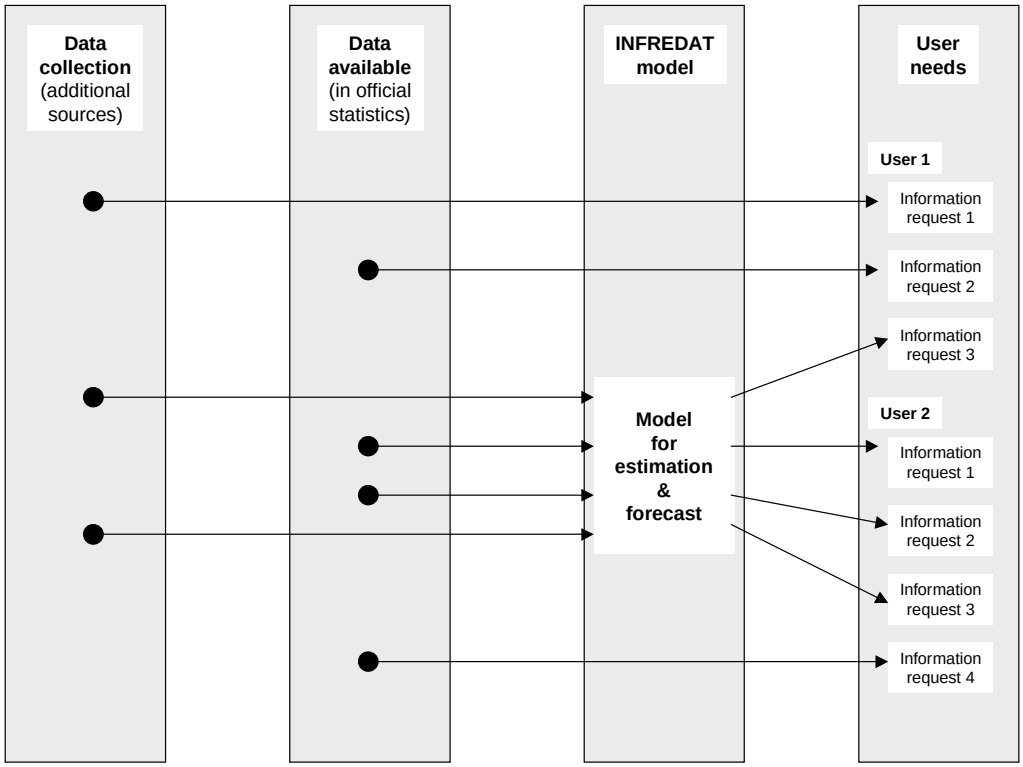
3.5 Modelling for data estimation and forecast

3.5.1 Context of the model

General context

The following figure presents the context of data need and data supply. There are different levels of data needs and supply. To be able to come to the information needed by the users, available data and additional sources that are directly applicable to answer the questions have to be used. Still data gaps will remain that need to be filled by modelling. For modelling also data is required that come from existing sources and additional sources.

Figure 3-2: Data need and data supply



ETIS context

The model and data base to be developed in INFREDAT has to become a part of this ETIS (European Transport and Information System) and therefore systems being developed in MESUDEMO are applicable to the INFREDAT results. In this sense, the whole ETIS is relevant for INFREDAT. Since all data types are being analysed in MESUDEMO, in INFREDAT only the system elements are analysed related to inter-modal data in the strict sense and not elements like for instance socio-economic data and network data.

3.5.2 'Pragmatic' approach to transport chains

Experience with transport chain data bases shows that it is not easy to use transport chain information to its full extent and to make the right interpretations. Even if only one transhipment location is included, new insights can be obtained resulting in a better understanding but also resulting in spending more effort to find the right meaning of the data. Expert data base users or sophisticated data extraction software can help overcoming this difficulty.

Despite such difficulties, transport chains must be seen as a powerful tool with which much more information will be available than now is the case. The fact that besides the economic relation also the transport relation is preserved, makes it possible to obtain better understanding of the economic mechanisms behind transport. This in its turn will lead to better understanding of the implications of policy decisions.

In the following, the most relevant questions for the INFREDAT model are summarised. The concept of transport chain requires that definitions are clear and well used.

What is the scope of the data base?

It should be noted that the INFREDAT model should aim to be a policy support system. The purpose of the data base is to be able to get more insight in the inter-modal freight transport flows. It should be possible to analyse specific routes followed, terminals used, and corridors, to have insight on a more aggregated level. It must be possible to bring the inter-modal transport in the context of total trade / transport and uni-modal transport, also to be able to make comparison with other types of transport.

Which type of transhipment to include?

All types of transhipment where inter-modal transport takes place should be included. Therefore, all locations where a change of active mode takes place should be included.

How to include simultaneous mode use in the data base?

Simultaneous mode use can be best implemented in a data base by using a variable for the active mode and one for the passive mode in a transport chain structure.

Table 3-12: Example of Simultaneous Road use Registration

Active mode	Passive mode	Meaning
Sea	Road	Commodity on a truck transported by a ship
Sea	Rail	Commodity on a train transported by a ship
Rail	Road	Commodity on a truck transported by a train
Rail	-	Commodity transported by train

How to include loading units in the data base?

It is recommended to include the loading units in the same data base as the commodity flows. It should be noted that a distinction is to be made between the number of tons transported by the loading units and the number of loading units transported. A flag variable is to be introduced indicating that either no loading unit is used or the number of loading units that is transported.

A possible extension to this method is to include also a type of container (large, other). Still a further extension would be to include, instead of a variable for container only, a variable for classification of loading units types.

How to include empty loading unit flows in the data base?

The number of empty loading units can be indicated using a flag variable 'empty container' introduced under the previous question. When no weight is indicated in the respective record, this implies that it concerns empty loading units.

How many links (transhipment points) to include in the transport chain?

Including all links on a trip from origin to destination results in a very large data base. Limiting the number of links can cause difficulties in interpretation of the figures extracted from the data base. Restricting the number of transhipment points restricts the application possibilities of the data base. It therefore has to be concluded that no restriction on the number of transhipment points should be made.

Which aggregation level for commodities should be used?

The collection of the data should be done with as much detail as possible on the commodities. The source with the most aggregated data and the methodology to be applied eventually determines the level of detail on the commodities. The main goal is to serve the EC with this data base to answer policy decisions, i.e. no very detailed information is needed. In case it is possible to come to a detailed data base, this is preferred since then also the organisations supplying the data can be served by it.

Which geographical aggregation level is needed?

The collection of the data should be done with as much detail as possible on the terminals and regions of origin and destination. The sources collected and the methodology to be applied eventually determines the level of detail on the geography. Most likely, the NUTS II level is possible for the origins and destinations. The transhipment locations should preferably be at terminal level.

3.5.3 Review on existing models and their limitations

The actual choice of the model to be used is depending on the data available and the specific data / information to be estimated. In this respect, it is not possible to describe the possible model in full detail. It is possible, however, to describe some of the main type of models.

The following models were considered:

1. The NEAC model of NEA
2. Freight model of Kessel & Partner
3. Polydrom model of ISL
4. STEMM model of MDS Transmodal

It should be noted that of course much more models have been developed. Detailed characteristics such as input and output data, processing methodology and performance indicators of the models have been investigated and reported in the INFREDAT deliverables D2 and D4; see list of publications.

From the analysis of the different models it can be detected that each model makes use of an OD matrix method after which an assignment procedure is used to obtain (additional) mode and route information.

For the construction of the OD matrix different methods are being used. Models from Kessel+Partner and ISL construct the OD matrix by applying models using socio-economic, network and costs input variables. Here, the OD matrix is estimated on functional relations between these variables and transport movements. The model of MDS Transmodal starts off with creating an OD matrix by commodity by using trade data, and it uses its estimation at a later phase for the identification of the modal split and route choice. In the NEAC transport chain data base construction model, no estimation of transport flows is used in the OD-matrix construction phase with the exception of the region-region determination. Trade and transport sources are combined to construct the data base resulting in region-region information by commodity, transhipment information where sources are available, and mode before and after transhipment.

Table 3-13: Model comparison

Model	OD data	Commodity	Modal-split	Route / transhipment
NEA; standard NEAC (without OD-ESTIM or Multi-modal assignment)	Observed trade / transport; Match region-region estimated with observed regional trade / transport Coverage EU 15, EEA + 13 Eastern Europe countries	Observed	Observed	Observed
K+P; InterTrans, RegioTrans, CityTrans	Observed on aggregated level Estimation on desegregated level or missing data demand / supply / distribution Coverage Europe with details on some areas	Observed on aggregated O/D level; Estimation when more detail	Inland modes only; Estimated	Inland transhipment; Estimated
ISL; Polydrom	Estimation demand / supply / distribution	Estimated	Estimated	Estimated
MDS; STEMM	Region-region data by combination of different sources for UK and observed Transalpine	Observed	Estimated	Estimated

It is clear that at any stage of the OD matrix construction procedure estimation of missing elements is possible. When developing the INFREDAT model, a top-down approach is used. Existing trade and transport data has to be used as much as possible. Any of the estimation procedures described in the different models can be of use in case data might be unavailable. The choice of the type of model to be used in the first place is depending on the specific data / information to be estimated.

All methods based on modelling are able to provide forecasts. Conversely, only a minority of the methods analysed are able to perform the selection and ranking of present and future inadequacies in networks, or the analysis of policy impacts.

The 'operational' models, which have been used several times for 'clients', are based in majority on a top-down approach. Methods using survey approaches for data collection are still at a research level and have been generally tested on a limited number of pilot cases.

The degree of inter-modality of the data produced is contrasted, from 'sophisticated' inter-modal data giving the transport chain characteristics to uni-modal data, which may be useful however, for modelling purpose. The main types of data produced are:

- Transport chain flows by O-D, for unitised and non unitised traffic (MDSt, NEAC)
- Transport chain flows by O-D, for unitised traffic only (Kessel+Partner, MDSt)
- Distance, time, cost and capacity use for one or several links of the transport chain (ISL)

In the context of the INFREDAT project, all above methods are potentially useful, even if they do not all produce 'real' inter-modal data.

Main limitations of existing models

The main limitations identified can be summarised as follows:

- Price and costs changes are not taken into account.
- No real inter-modal data but only containerised traffic are produced.
- The access to data is restricted to members only, except for aggregated data.
- There is no modelling of the transport chain.
- Only global data or rough estimates, are provided.
- There are difficulties to get enough data to be able to aggregate.
- High cost of data collection (large surveys).

Moreover, several methods are facing the crucial problem of the lack of intra-European trade data. As a whole, each method appears as a compromise between the degree of detail of data produced and the cost of implementation. The problem of the accessibility of the models / methods is key. It raises the question of the adequate organisation which would have to be set-up to protect the confidentiality.

3.5.4 The INFREDAT Estimation Model

Before creating a new model for inter-model transport, a look has to be taken at the required end results of the model. Bringing this into relation with the data that could be found, a first opinion on the possibilities and impossibilities of the model to be developed can be given. This will give a first indication on the model type that needs to be constructed.

In the method to be described, top-down and bottom-up elements need to be combined. The top-down approach starts of with trade flows containing the total of all transport at an origin-destination level of the commodities. Step by step, all route and mode information is included with data on regional detail, transhipment, and other route information. The route information can be collected with the bottom-up approach. Different terminals have data on the incoming and outgoing modes, its origins, destination, commodity types, and more.

The main characteristic of the **bottom-up approach** is that the data collected on the chain of transport refers to the elementary shipments. Three main approaches deal with this method: surveys, automatic extraction of digital data from computerised systems, and institutional collection. Provided that they are strictly applied, these methods seem to be the ones which provide the best quality of information. However, the surveys are relatively costly and are best seen as occasional bench mark surveys rather than a continuous collection process.

The principle of the **top-down approach** for data collection consists of constructing a data base in which available partial information about different parts of the aggregated flows is made mutually self-consistent by various estimation methods. The main steps of the top-down approach are to identify trade flows and to use transit transport data where available. Regional data, international trade data, region to region, or region to country as well as international transport data from region to region are also included. Generally, top-down approaches need to be combined with the collection of a sample of real data to adjust the model parameters and to check the results.

General model structure

The main issue is that all inter-modal aspects should be included in the data base. This implies that the route needs to be described that is followed along the different terminals, the modes, and the loading units used.

For the construction of the transport chain data base with different sources, a top-down approach should be used. The top down approach implies to start of with a backbone of trade data. This information can be at a rough country-country level without any information on the routes followed. All information in this trade data base will be unchanged along the process, i.e. the eventual data base can produce the same trade figures (by aggregation) that were used at the starting phase. These trade flows are refined in the next steps by including information from other sources, such as regional information, transhipment flows, terminal flows, container indices, etc.

In the context of the INFREDAT model it is important to take into account the fact that quite a lot of data sources have to be dealt with. In the ideal situation most of the terminals, inland and maritime will deliver data. Therefore, an efficient method has to be identified that can make use of as much information and data as possible, but is not being held back by the poorest source.

The general structure of the model to be used can be split up into four different parts:

1. Combining trade / transport / transhipment data sources
2. Estimating data gaps
3. Estimating estimating / calibrating inter-modal transport
4. Estimating Loading units flows

In the first part, all available trade and transport data sources are being combined into one data base by a top-down approach. It might be the case that some regional information is missing in transport or trade data, or that no data are available at all for a specific geographical area. In this case, estimation methods are required that can estimate data by modelling. Inter-modal assignment procedures have to be developed to include missing information on route choice and terminal use that could not be included in the first part of the model. Finally, procedures have to be developed to estimate loading units flows with data to be found.

Combining trade / transport / transhipment data sources

The first step in the top-down approach is to combine all collected trade / transport sources into one data base. The trade data is used as the foundation of the whole data base which is refined with information that can be found in the transport and transhipment data sources. In INFOSTAT, a pilot data base with two transhipment points has been constructed with the top-down approach. A conclusion was that for all elements of the chain, data should be available to ensure quality of the results. Up to this point, two transhipment points in the chain structure by combining sources seems to be the limit on the level of detail. Further refinement needs to be found in multi-route inter-modal assignment procedures.

Estimating data gaps

Which data to be estimated of course determines the method to be used. In several of the models investigated in the course of INFREDAT, estimation procedures are contained.

The models of Kessel+Partner and ISL - Institute of Shipping Economics and Logistics (both Germany) use a four step approach to estimate data. These models are very well applicable for filling data gaps. At this stage the OD-ESTIM project (4^{th} framework EC) is worth mentioning. In this project, different models are tested for estimation of transport data based on the four-stage model of generation, attraction, distribution, and model-split. Models are

developed for different levels of availability of data ranging from no transport data at all to estimation of only the modal-split.

Estimating / calibrating inter-modal transport

When ready to apply estimation procedures for inter-modal transport, a data base already has been constructed by the data base construction method by combining available and estimated data sources. In the previous steps, only available transhipment data have been included. This constructed data base needs to be refined with additional transhipment points.

It is not to be expected that for all transhipment locations data will be available. Only the most important or the largest terminals can be considered. These terminals are part of transport chains with at least two transhipments.

The collected terminal information can be used to calibrate a multi-route inter-modal assignment model. Not only terminal flows are needed or can be used, also traffic counts, cost and time parameters, etc. can be included. These models find the optimal route with the calibrated values for the parameters in a multi-modal network. In this way, also transhipment is being found when changes of mode takes place in the multi-modal network.

Estimating loading units flows

Inclusion of loading units in the data base has to be done with particular care. Commodity flows are needed in a fist step, because only transport volumes per commodity are estimable (e.g. as a result of economic development). The used loading units are derived quantities depending on logistic reasons. Therefore, a rule has to be developed to transform the goods flows in loading units. This rule can be a set of shares or something else, e.g. the description of the suitability of specific loading units for specific goods. Thus, with an aggregate data base, one can build the transport flows. The rule has to be developed from the observed, real transport, where the item

- commodity x in unit y

has to be collected. All commodity flows have to be included in the data base to be able to estimate the probability that a loading unit on a specific relation is carried in inter-modal transport in any way.

3.5.5 Data base construction pilot

Corridor Poland - Netherlands

The methodology elaborated was tested on the corridor Poland – The Netherlands, one of the three pilot cases. The test concentrated on the methodology to combine sources to a transport chain data base and estimation of loading unit flows. Due to the fact that rail terminal data are not available it was not possible to test a multi-route assignment procedure on a multi-modal network for calibrating / estimating inter-modal transport routes. This pilot serves as an example of how the INFREDAT model could be applied. The methods applied here are dedicated to the available data sources, to be able to obtain the maximum of information possible.

When analysing a corridor, many different transport flow types should be distinguished. Often only the flow type is selected for such an analysis with origin at one side of the corridor and the destination at the other side, i.e. the trade or the transport between the two end points.

The reason for this is often the limitations of the budget that does not allow extensive data collection and data base construction.

The corridor Netherlands-Poland comprises, besides transport (chains) with origin and destination The Netherlands and Poland, also transport chains passing the Polish territory and transport chains that pass through The Netherlands, Belgium and Germany with origin or destination Poland. Many more flow types using at least part of the corridor can be distinguished. In addition to the east-west flows through Poland, for example flows with origin Lithuania and destination The Netherlands, when doing for instance a potential analysis, one could for instance also add the fraction that is bypassing Poland and take a route via the Czech and Slovak Republic. On the basis of geographical characteristics the latter flow could, with the right service characteristics for instance at the Polish border, better be accommodated via Poland.

Concluding it can be stated that when doing a thorough corridor analysis many different data sources are needed. To be able to work with all these different sources in a consistent and convenient way, they should be combined into one single data base. All trade, transhipment and other route information need to be combined into a data base with a transport chain structure.

Construction of the Transport flow data base

Once all the needed sources have been gathered, they have to be linked together resulting in one consistent data base. The philosophy of the transport chain principle that has been used is that the transport flows are determined by the trade flows; preserving the trade relation and follow the route of the goods transported. This means that besides the origin and destination, a place of transhipment and the modes before and after transhipment will be known. To do this a top-down approach was used, which means the rough country to country trade information was taken and refined step by step using the various national data sources. Using this approach, it is possible to introduce the most desegregated level permitted by the data sources available in each individual country without being limited by the lack of data in other countries.

Applied to the flows covered by the study, the methodology of construction can be considered as four steps:

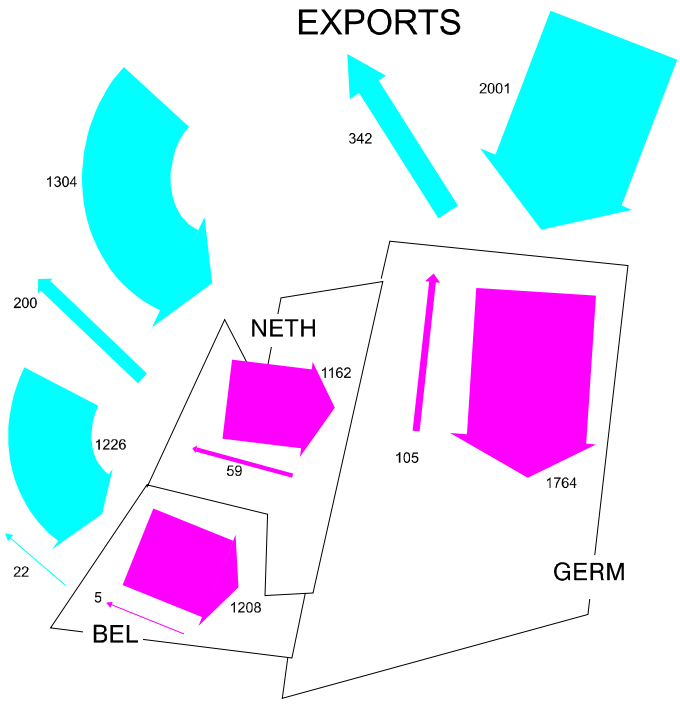
1. NEAC
2. Polish data base
3. Combine NEAC and Polish data base to the corridor data base
4. Estimate the container flows

This method has been described in more detail in D3 of this project (see list of publications).

Results

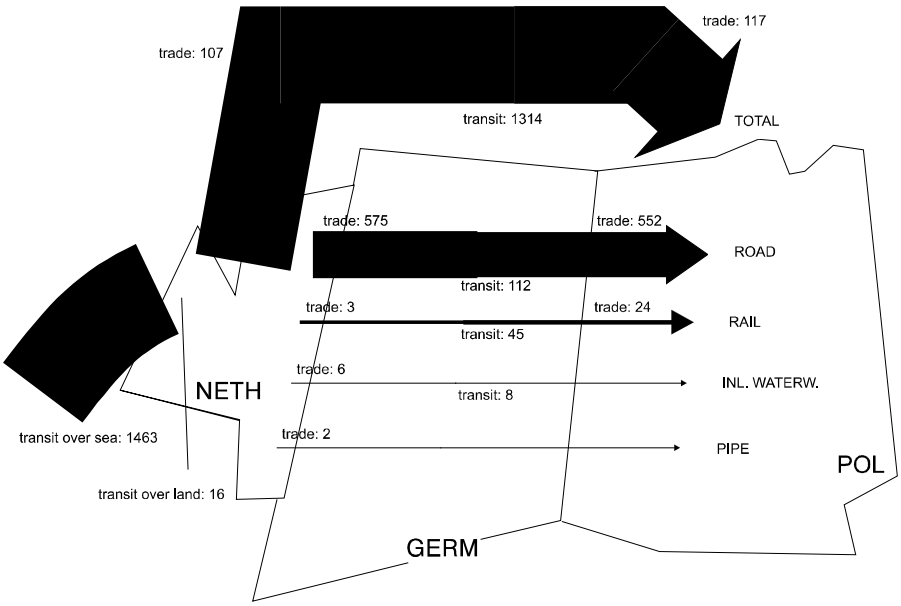
In the following, some results of the data base constructed are presented. Some interesting elements are picked out and shown in figures. In Figure 3-3, the part of the exports of Poland that is transhipped in the ports in Belgium, the Netherlands, and Germany is shown. Land-sea as well as sea-land mode combinations are represented both in the same figure. The advantage of having this information is that all information is consistent and based on the same total trade flow from Poland to the Netherlands.

Figure 3-3: Exports of Poland transhipped in NL, B and D, 1997 [tonnes x 1000]



In Figure 3-4, the Dutch trade and transit through Dutch ports being imported by Poland are shown. Besides the fact that the different routes followed can be compared, differences in modal-split on the Dutch and the Polish side concerning mainly road and rail can be detected. This difference gives an indication that transhipment has occurred in Germany. In case terminal information can be made available, this can be specified.

Figure 3-4: Imports of Poland, Dutch trade and transit through Dutch ports, Routes by mode, 1997 [tonnes x 1000]



In Figure 3-5, the trade of the Netherlands, Belgium, and Germany is presented together with the transit through Dutch ports imported by Poland. In Figure 3-6, the same flow types are shown but now for the containerised transport. The information in both figures is extracted from the same data base and is consistent. Therefore, it is possible to draw conclusions on the share of a specific container flow of the total transport to Poland along this corridor.

Figure 3-5: Imports of Poland, Trade of NL, B, D and transit through Dutch ports, Routes, 1997 [tonnes x 1000]

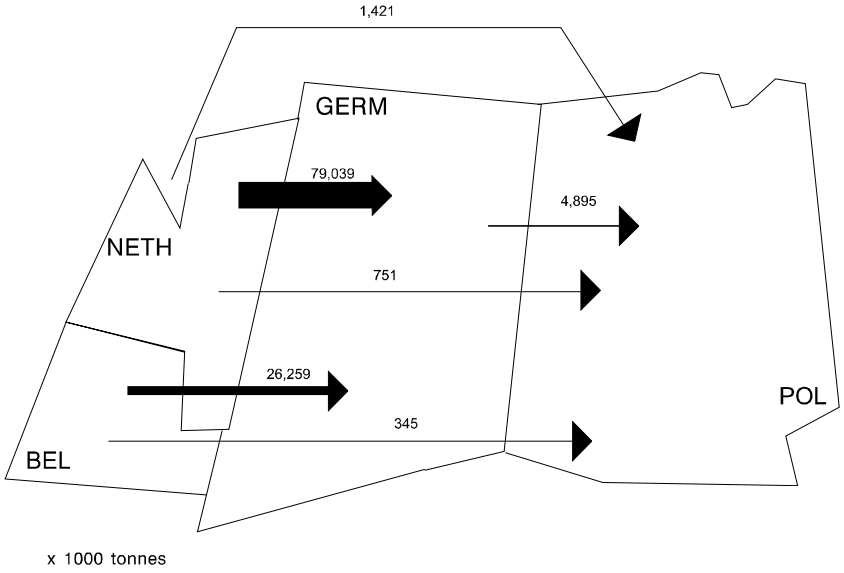
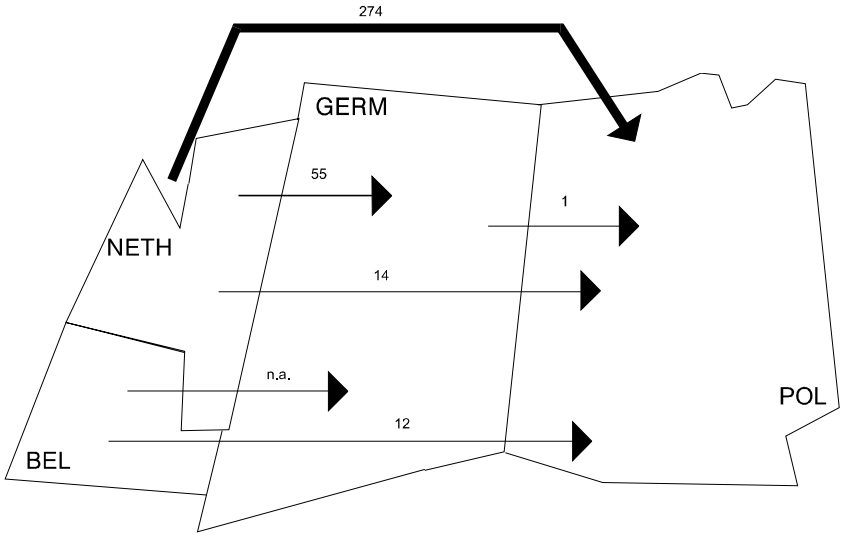


Figure 3-6: Import of Poland, Trade of NL, B, D and transit through Dutch ports, containerised, Routes, 1997 [tonnes x 1000]



Conclusion on this pilot case

This pilot case has shown that by combining sources it becomes possible to analyse the different routes used along a corridor. All results are consistent and market shares of certain

routes can be calculated. Furthermore, it is possible to calculate the container flows on the different routes. From differences in modal split between different sources, information on transhipment at terminals can be derived.

Estimation of flows via rail terminals cannot be performed yet, due to limitations in data availability at the moment. Furthermore, multi-route assignment procedures on multi-modal networks have to be further elaborated to improve quality of results.

3.6 Data collection approach

The data collection approach described is a proposal of alternative suitable data collection methods, which allow the construction of a data base for inter-modal transport.

As already stated, the most significant user of the INFREDAT data base will be the 'Public Sector'. Equally, INFREDAT has to provide the solution for a data collection method as the principle framework for the establishment of a data base for inter-modal freight transport data considering the requirements of the most significant users. Therefore, recommendations for a specific INFREDAT data collection approach are worked out.

3.6.1 Data to be collected

The following table gives an overview on the needed data derived from the users requirements side and from the modelling point of view, grouped by categories and corresponding items. For the data collection approach, it is not necessary to distinguish between user needs and needs for modelling, because both data sets match each other nearly completely.

Table 3-14: Data request – categories and items

Categories	Items
Basic networks	Link Type of link Distance Speed Link class Pricing for use Link capacity Link characteristics
General transport data	Transport flows
Trade flows	Trade flows
Socio-economic data	Population Employment Production by sector
Transfer points	Relations / services offered Transport time Position in network Transhipment volume Catchment area Transhipment capacity Warehousing capacity Handling equipment Cut-off time Transhipment costs Additional services
Inter-modal transport services	Relation / services offered Transport time
Inter-modal transport volume	Transport volume Transport cost
Transport chain structures	Origin / transhipment point Transhipment point / destination Active mode Passive mode Number of loading units Type of loading units Commodity Hazardous / perishable Value Total transport cost Weight (gross / net)
Inter-modal transport performance	Bottlenecks Delays (degree of in-time-delivery) Accidents Special price conditions

The term 'item' indicates in the system the order of the data collection approach at the level of most detailed data. E.g. 'link' stands for the numerical description of a link in a network model: the codes and co-ordinates of two nodes. Items are grouped to 'categories', which means that categories contain items describing the same phenomenon.

Some of the items represent a summary of more detailed data; e.g. in the category 'transfer points' the item 'relations / services offered' describes all possible relations from a specific terminal and all offered services are summarised. The source and the collection method for all these pieces of information is the same, and therefore the consideration of the aggregate item is justified.

The categories and items from Table 3-14 build the basis for the classification of the data and for the development of sets of collection methods for inter-modal data.

It is important to mention that the categories **'Inter-modal transport volume'**, in particular in comparison with actual infrastructure capacities, and **'Transport chain structures'** represent the relevant information, the target data. The items of the category 'Transport chain structure' reflect the data base structure defined. Other items, like 'link classes', 'link characteristics', 'population' and 'employment' are needed for construction and calibrating a model for the estimation of relevant inter-modal data and transport chain structure.

3.6.2 Data collection methods

In principle, there are four data **collection methods** for inter-modal transport data:

- Analysis of statistical reports
- Analysis of publications, internet web-sites and other relevant reports, research projects
- Surveys, interviews, traffic counts etc.
- Constant collection of current data

At first sight, the two **analyses** seem to indicate the same method, but in case of the analysis of statistical and other relevant reports the contents of the sources is previously known, whereas analysis of publications and internet web-sites is a systematic selection of possibly interesting sources. Various data can be derived from these sources, for instance web-site of sea-ports, 'DVZ-Deutsche Verkehrszeitung', publications of professional associations, 'Container Yearbook'.

Surveys and interviews are specific methods to collect data, which are either representative of the entities in that group or representative in describing specific market behaviour which is transferable to different sites or transport corridors. In some cases where confidentiality of survey data is involved, a simple method of data collection is traffic counting, e.g. the counting of incoming and outgoing trucks at the main gate of a terminal. In combination with other data or non-confidential survey information, traffic counts might a useful but expensive data resource.

The last mentioned method of **constant collection** indicates a method for highly dynamic or unstructured events, like accidents, bottlenecks, delays, etc. For these types of information specific methods have to be used in order to provide a permanent check of the current characteristics of inter-modal transport.

3.6.3 Assignment of sources to categories / items for each collection method

In the following figures (Figure 3-7 to Figure 3-10), suitable sources for each data category / item are shown. To clarify the connections, separate figures for each collection method are shown.

The structure of the figures is the same for all methods. On the right hand side the data sources and on the left hand side the data categories / items are named. Sources which play a similar role for data collection are listed in the same box. For example, journals and consultants both deliver information in publications and studies that can be used, but is rarely specific for the respective item. For each method, the connections between both entities are indicated by arrows. It is shown that for some items within each method several sources with suitable information for the different items are available. E.g. within the method 'collection

from publications', the data for the transhipment volume in transfer points can be collected from relevant EC studies, from journals or research studies of consultants, and from publications of operators of combined transport / maritime companies, as shown in Figure 3-8.

Figure 3-7: Suitable sources for items – *method*: collection from statistical data

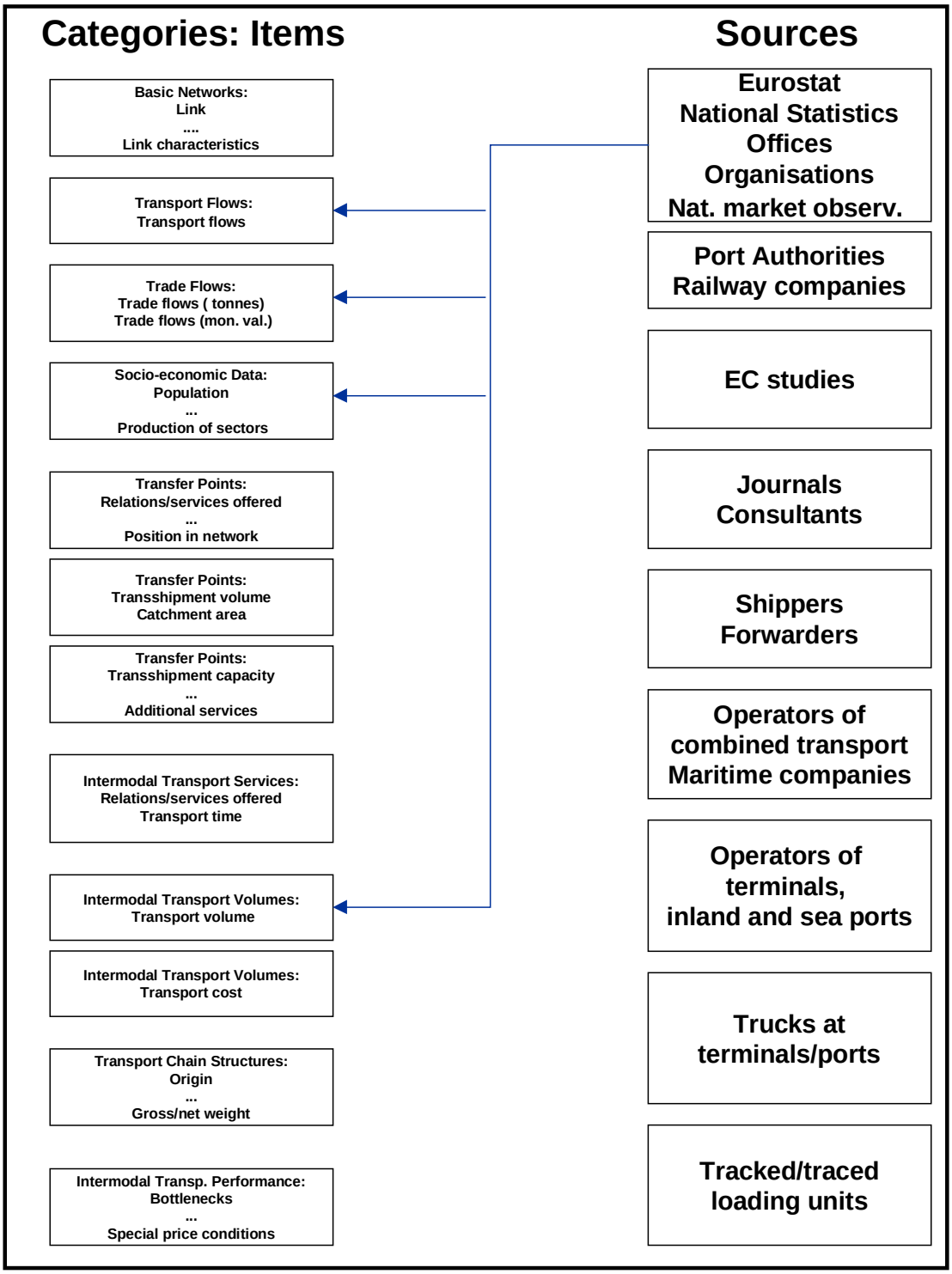


Figure 3-8: Suitable sources for items – *method*: collection from publications etc.

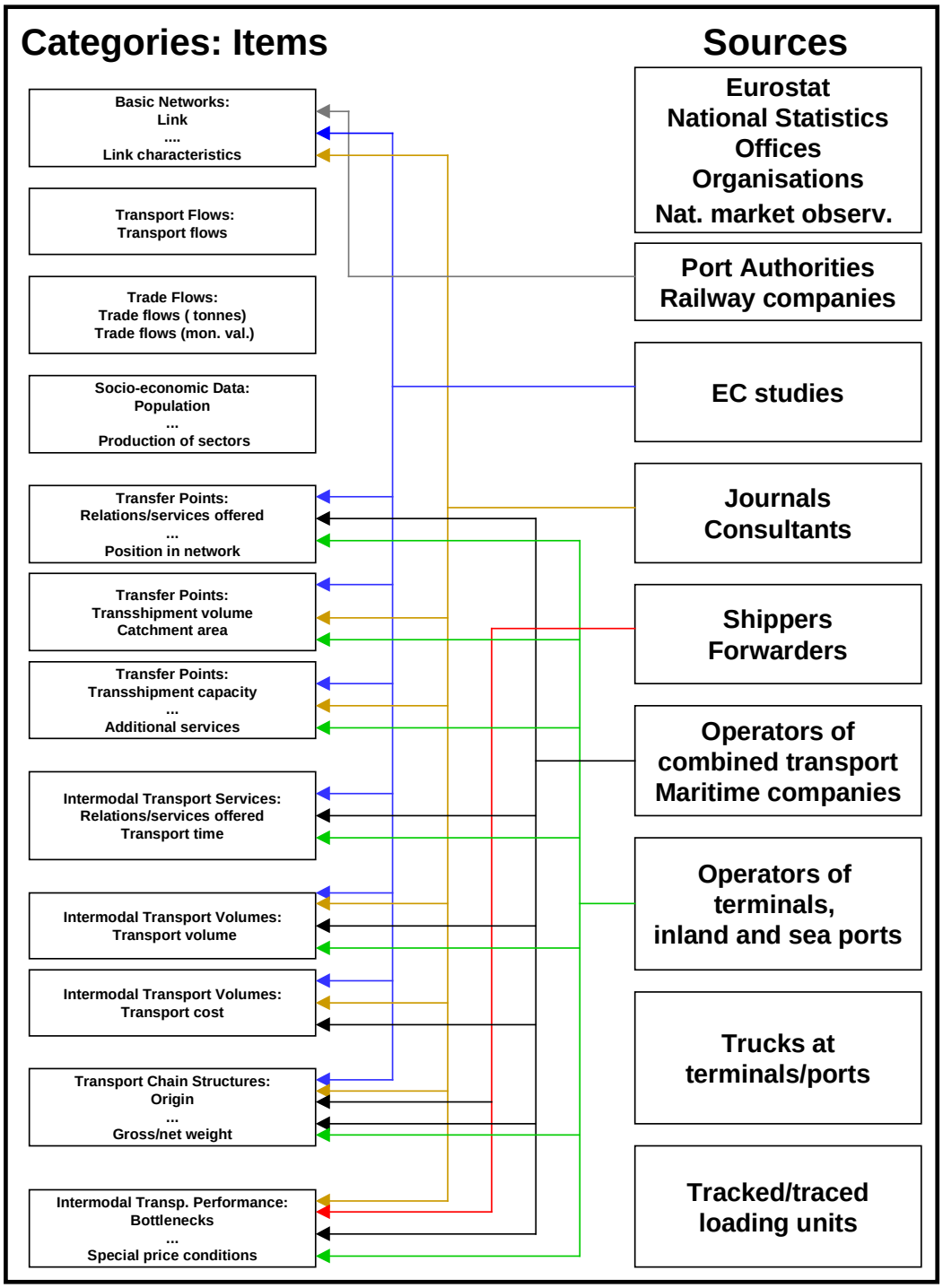


Figure 3-9: Suitable sources for items – *method*: collection from surveys etc.

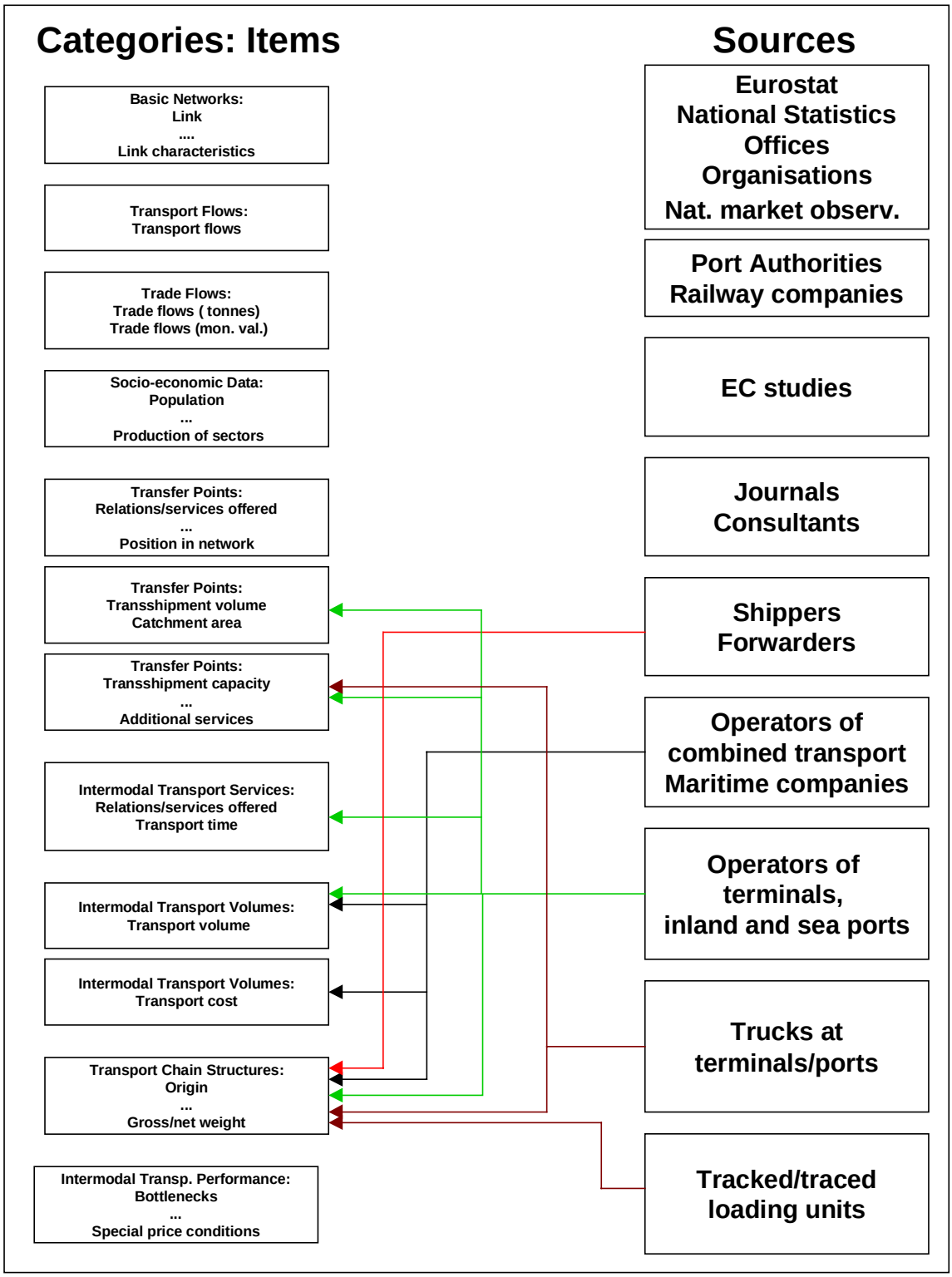
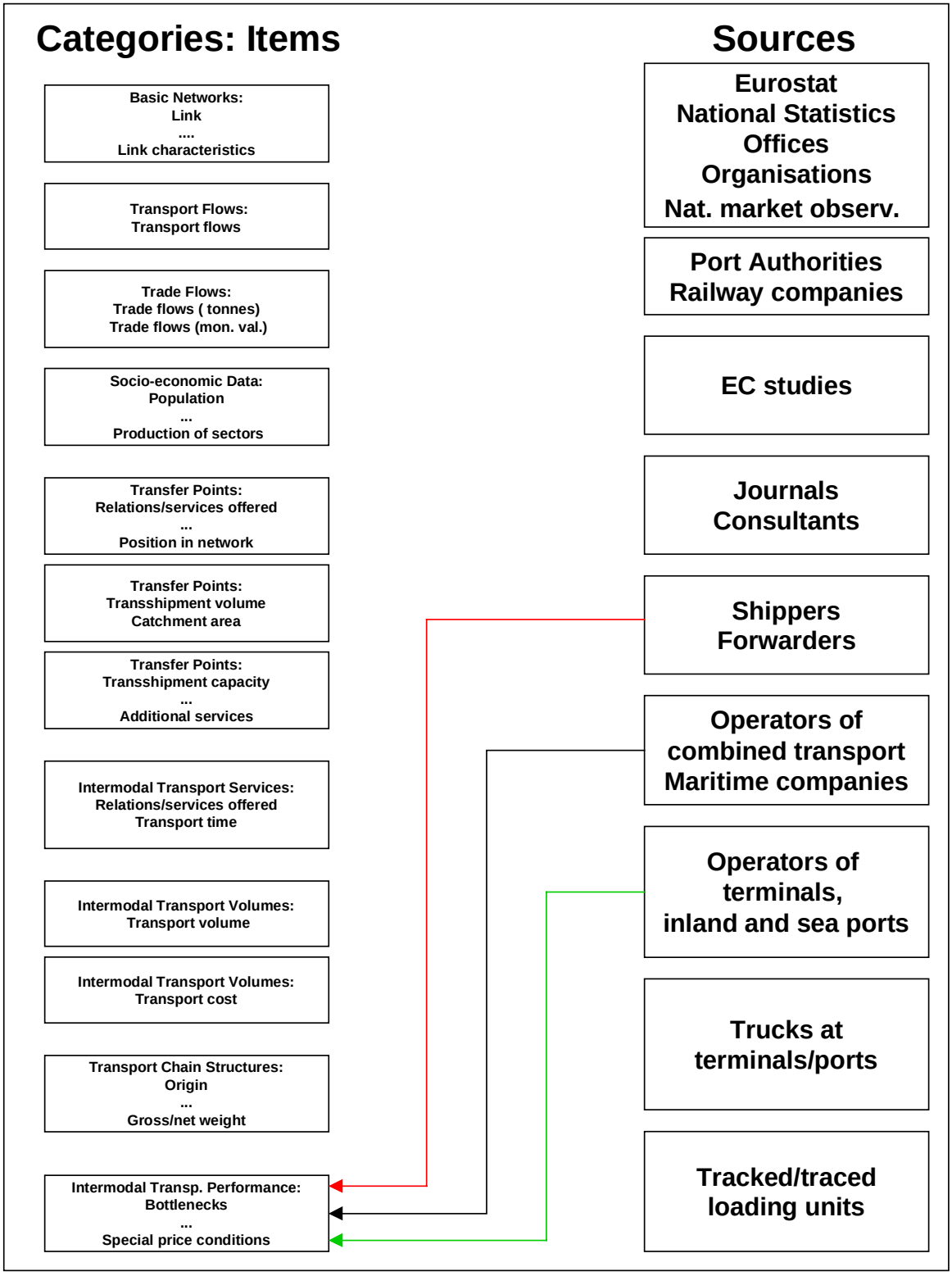


Figure 3-10: Suitable sources for items – *method*: constant data collection



3.6.4 Possible collection system

In the following table, collection methods, data categories / items and sources are combined in terms of 'modules' to obtain workable alternatives and to make the complementary or substitution of these alternatives transparent. The table contains the possibilities for data collection applying one exemplary method.

Table 3-15: Exemplary Structure for Data Collection by Modules

Module	Category	Item	Source
1.1	General transport flows	Transport flows	Eurostat National Statistics Offices
	Trade flows	Trade flows (tonnes) Trade flows (monetary value)	Eurostat National Statistics Offices
	Socio-economic data	Population … Production by sectors	Eurostat National Statistics Offices
1.2	Inter-modal transport volume	Transport volume	Eurostat National Statistics Offices National market observation
2.1	Basic networks	Nodes … Special characteristics	Authorities Railway companies EU studies of 4th FP Journals, consultants
	Transfer points	Relations / services offered Transport time Position in network	EU studies of 4th FP Operators of combined transport; maritime companies Operators of terminals, inland ports, sea ports
	Inter-modal transport services	Relations / services offered Transport time	EU studies of 4th FP Operators of combined transport; maritime companies Operators of terminals, inland ports, sea ports
3.1	Transfer points	Transhipment volume Catchment area	Operators of terminals, inland ports, sea ports
	Transfer points	Transhipment Capacity … Additional services	Operators of terminals, inland ports, sea ports
3.4	Inter-modal transport volume	Transport volume Transport cost	Operators of combined transport; maritime companies
3.5	Transport chain structures	Origin … Gross / net weight	Shippers / forwarders Operators of combined transport; maritime companies Operators of terminals, inland ports, sea ports
4.1	Inter-modal transport performance	Bottlenecks … Special price conditions	Shippers forwarders Operators of combined transport; maritime companies Operators of terminals, inland ports, sea ports

In this example, the category 'Inter-modal transport volume' is collected twice, by module 1.2 and 3.4. The sources for module 1.2 are Eurostat and available national statistics. It means that only aggregate data is available from this sources. To calibrate the model, however, detailed data on a specific route are needed. Therefore it is useful to apply module 3.4 and to use survey data from transport operators to fill the gap.

Possible system alternatives differ from each other in two aspects:

1. different combinations of data collection methods and sources for the items,
2. within each collection system different methods of data transfer from the data origin / source to a data base on a computer, e.g. by paper or telephone or internet.

The general idea for the derivation of what is called a 'construction set' for a data collection system is to construct a complete data base for inter-modal transport. If such a data base is in operation, well defined methods for data transfer, collection, calculation, and updating of data are necessary and the whole system has to work like an 'algorithm'. Different ways to realise such a system are possible.

3.6.5 Specific INFREDAT data collection scenario

For defining the INFREDAT data collection approach, it was necessary to identify a realistic combination of organisation and method for the data collection. A discussion took place in the October 1999 Advisory Committee meeting, and three different scenarios were proposed. The preliminary features of these scenarios were identified as follows:

Table 3-16: Scenario features

Item	Scenario A	Scenario B	Scenario C
Organisation	Public & centralised	Private & centralised	Private & customer based
Data collection approach	Modelling	Survey / Count	Count / Collection
Main User	Public sector	Transport industry	Transport organisations

It was suggested to define these different scenarios to limit the great variety of possible data collection methods to the most likely ones, considering main user needs, collection methods, organisation of the collection processes, and different time frames, i.e. short, medium, and long term. The discussion brought into focus that the most important user of the INFREDAT data base will be the 'Public Sector', especially the European Commission, Eurostat and the national governments. Therefore, all proposed scenarios have to consider the needs of the 'Public Sector' and have to guarantee the full access of these users to the INFREDAT data base. This will be straightforward in the case of scenario A, but is relevant also for the alternative scenarios B and C, which are more substantially based on private initiative.

The **Basic Scenario** builds the kernel of the methodology for the collection of inter-modal freight transport data across Europe. The characteristics of the Basic Scenario are:

- All the necessary data come from statistics, publications, internet-research etc.
- The missing but necessary data have to be estimated by a specific model, which is outlined in the chapter above.
- The Basic Scenario allows quick initial results, could be established soon, and is a long-term solution.
- Collection and processing of data can be administered directly by the European Commission (EUROSTAT) or by contract with a private company.
- The quality of data meets the needs of the primary user, the political authorities.

In addition to the Basic Scenario, **surveys and counts** are carried out to improve the data and the model for the Basic Scenario. The characteristics of this 'additional scenario' are:

- The Basic Scenario remains unchanged.
- The additional scenario is used to provide additional information in order to improve data, parameters and the model itself.
- The responsibility for the data collection remains with the 'Public Sector'. Otherwise, there is no guarantee that the data will be available. This may need a directive or a legal act.
- The additional data could provide further benefits to other users of the data base, because surveys and counts give a more detailed insight into the structure of the inter-modal transport market.

The surveys and counts need to be carried out at fixed time intervals in order to check or to recalibrate all relevant data, parameters, and models, e.g. every 3 or 5 years.

Thus, the design of the Basic Scenario has three fundamental components:

1. **Direct sources**: Data collection from directly available sources every year
2. **Interviews**: Data collection from interviews every 3 years
3. **Counts**: Data collection from counts every 5 years

This Basic Scenario for a workable data collection approach for INFREDAT respond to the data needs of the most important users of the inter-modal data base and is flexible enough to extensions of data needs, data sources, or data transfer methods.

The modules needed for the Basis Scenario data collection are shown in the following table.

Table 3-17: Modules of Basic Scenario

Module	Category	Item	Source
1.1	General transport flows	Transport flows	Eurostat National Statistics Offices
	Trade flows	Trade flows (tons and monetary values)	Eurostat National Statistics Offices
	Socio-economic data	Population … Production by sectors	Eurostat National Statistics Offices
1.2	Inter-modal transport volumes	Transport volume	Eurostat National Statistics Offices National market observation
2.1	Basic networks	Nodes … Special characteristics	Authorities, Railway companies EU studies of 4th FP Journals, consultants
	Transfer points	Relations / services offered Transport time Position in network	EU studies of 4th FP Operators of combined transport and maritime companies Operators of terminals, inland ports and sea ports
	Inter-modal transport services	Relations / services offered Transport time	EU studies of 4th FP Operators of combined transport and maritime companies Operators of terminals, inland ports and sea ports
2.2	Transfer points	Transhipment volume Catchment area	EU studies of 4th FP Journals; consultants Operators of terminals, inland ports and sea ports
2.3	Transfer points	Transhipment capacity … Additional services	EU studies of 4th FP Journals; consultants Operators of terminals, inland ports, sea ports
2.4	Inter-modal transport volumes	Transport volume Transport cost	EU studies of 4th FP Journals; consultants Operators of combined transport and maritime companies
2.5	Transport chain structures	Origin … Gross / net weight	EU studies of 4th FP Journals; consultants Shippers / forwarders Operators of combined transport and maritime companies Operators of terminals, inland ports and sea ports
2.6	Inter-modal transport performance	Bottlenecks … Special price conditions	EU studies of 4th FP Journals; consultants Shippers / forwarders Operators of combined transport and maritime companies Operators of terminals, inland ports and sea ports

The information which can be gained from statistics, publications, and so on is probably not sufficient for all data needs. Especially, the volume and structures of inter-modal transport chains are not available from statistical sources. Therefore, **modelling** will play a crucial role in the estimation of these data items.

The data from surveys and counts are not used to expand the data set, but to describe structures and their changes over time. The relevant modules, which have to be applied periodically, are listed in the following table.

Table 3-18: Modules applied periodically

Module	Category	Item	Source
3.1	Transfer points	Transhipment volume Catchment area	Operators of terminals, inland ports and sea ports
	Transfer points	Transhipment capacity … Additional services	Operators of terminals, inland ports and sea ports
3.2	Transfer points	Transhipment volume Catchment area	Trucks at terminals / ports
3.4	Inter-modal transport volumes	Transport volume Transport cost	Operators of combined transport and maritime companies
3.5	Transport chain structures	Origin … Gross / net weight	Shippers / forwarders Operators of combined transport and maritime companies Operators of terminals, inland ports and sea ports
3.6	Transport chain structures	Origin / transhipment points Active / passive modes Type of loading unit	Trucks at terminals / ports

The results of surveys or studies have to enable the modelling process to use characteristics and structures developed from the samples, and extend them to all regions of a study area and to similar commodities, respectively.

Modelling is the work step after data processing. The sequence is as follows:

1. Data collection through the data collection methods worked out in this work package
2. Data processing
   - Analysing data
   - Adapting aggregated data in order to get transport flows and transport volumes as a top-down approach
   - Extending and generalising non-aggregated data to other regions and to similar commodity groups as a bottom-up approach; use of data categories basic networks, inter-modal transport services and transfer points as input for modelling transport chains
3. Use of inter-modal multi-route assignment in order to form transport chain structures: This is the beginning of modelling in a narrow sense.
4. Analysis of derived data in order to obtain
   - inter-modal transport volumes by commodity types, regions, and modes;
   - inter-modal transport flows by commodity types, origin / destination regions, and modes.
5. Plausibility control: This is worked out in terms of
   - top-down approach: Data categories: General transport data, trade flows, socio-economic data, inter-modal transport volumes;
   - bottom-up approach: Check of reproduction of surveyed transport chains and of transhipment volumes at transfer points.

Tracking Operations for data collection

It is apparent that the emerging tracking technologies are already providing limited data of the type required by INFREDAT that makes them appear to offer potential for satisfying INFREDAT's aims. Indeed, with the rapid development of these technologies enabling the identification of more desegregated information and two-way communication between mobile tags and transponders, the potential looks even more enticing, with possibilities for INFREDAT to be implemented with only marginal costs once tracking operators have provided the infrastructure.

However, it is important to first accept that such operations focus primarily on a different (though related) task. Tracking operations are solely interested in reporting the location, and its comparison against a schedule, of a commodity flow at given or requested times to customers. Consequently, if a commodity flow is related at some level to a mobile tracking device, all that is needed for tracking purposes is a unique identification mark for the particular commodity flow.

It becomes clear that such operations are not necessarily best way to collect the INFREDAT data as summarised below:

- **Data inefficiency**: Identifying a transport flow through the assembly of numerous location observations is not an efficient method, particular when such flow information could be available at a single point, i.e. when determined by the shipper or forwarder.
- **Intervention**: No tracking system can completely avoid intervention with the transport industry as not all the required data can be ascertained without requesting shippers or forwarders to either input commodity data into dynamic tags or transponders or provide such information for the flows once identified by the INFREDAT tracking operation. Given the need for intervention, it is simpler to request full transport chain data as a single entity along with the commodity data.
- **Location identification**: AEI technology is capable of identifying all nodes in a transport flow, but this requires total coverage of the reader infrastructure. Without costly continuous observation, GPS and GSM systems would have to rely on inference where nodes are not observed.
- **Identification of flows**: Where commodity flows start and finish is not immediately apparent from the observation of the movement of a transport unit. Furthermore, any satellite-based systems that do not employ continuous observation could miss entire flows, and a very comprehensive identification system would be required to cover the whole EU.
- **High costs**: Even assuming fixed costs are only incurred at the margin due to infrastructure provision by tracking operators, INFREDAT requirements will necessitate a far greater number of observations than tracking customers need and would have to expect to absorb the related costs.
- **Conditions for success**: The only conditions where tracking and tracing could provide some inter-modal statistics – terminal to terminal only - would be where AEI was in use everywhere (i.e. at all modal interchange points). Sample surveys would be probably be unrealistic because every route would require sampling and once equipment is installed, a census is available, assuming all units were tagged. If only some units on a route were tagged, then grossing up would be needed, based perhaps on terminal data, but this would not produce a result which was significantly better than statistics available today. In

any case, without knowledge of the condition of the unit (at least full or empty plus weight), any statistics collected would be of very limited use.

Tracking & Tracing only provides a specific view of inter-modal transport data which is not sufficient for the INFREDAT data base as explained above.

On the other hand the actual and future potential of T&T as data collection approach is not fully known or investigated. In the continuation of INFREDAT, it could be useful to develop a specific view or extract of the data produced by T&T. E.g. if there is some information from an AEI method available, these data can be used to describe the transport chain of an ITU. In combination with data from other sources, e.g. trade data, and estimated data from the model, the needed results for INFREDAT might be produced.

3.6.6 Alternative methods of data transfer and their impact on data collection methods

Statistical data

In future, use of printed statistical publications as well as of electronic devices will be easy for data collection, because they are generally available and because processing data is very common. Gaining statistical data electronically is recommended due to low costs.

Schedules, publications, web-sites

Analysis of schedules, publications and web-sites specially works if surveys, counts, tracking, or constant data collection are not practible due to confidentiality or cost restrictions. Analysing these sources constitutes a systematic research method for the data categories / items. An exemplary research showed that this is a possible way to obtain information in order to replace or to complete surveys. To sum up the findings of a trial, when internet research was carried out, it can be said that it is not yet possible to evaluate the use of internet research exhaustively. The insight given by the exemplary research has shown that this is a possible way to get information. Detailed data bases of third firms are available in a few harbour regions only; this information can be applied to derive some plausible structure of port-related transport flows.

Surveys, counts

Despite of generally positive experiences with interviews carried out in the context of INFREDAT, surveys are the form of data collection with most confidentiality problems.

Counts at gates of terminals do not generate confidentiality problems, but only a limited set of items can be covered by using counts instead of surveys. The analysis of number-plates as an additional issue gives a provisional insight into the catchment area of ports / terminals.

Different technical possibilities of data transfer processes to make the collection methods operational are possible:

- Printed paper and coding or scanning
- Electronic device, e.g. CD-ROM, disc
- Telephone and coding of answers
- Face to face interview and coding of a questionnaire
- Counting of loading units
- EDI, GPS, GSM (tracking and tracing)

The specific transfer of the data is partly independent of the collection method. E.g. a questionnaire can be filled in during a face-to-face interview, or a telephone call, or by typing the answers in a questionnaire on a web-site.

3.6.7 Direct data collection - Limiting factors and obstacles

Three factors have an impact on data availability:

- **Technical factors** linked to the heterogeneity of information systems
- **Conceptual factors** linked to definitions and units
- **Confidentiality factors**

Heterogeneity of information systems

A wide proportion of shippers and operators have developed their own in-house software to manage their activity, told by 60% of companies interviewed who answered the question "*Which format of data do you use?*". There is no reason for these systems to be compatible, and generally they are not. Software is different, data collected / used are different and organisation of data is different, too. Originally, one main concern of companies developing their information system was to preserve confidentiality of data, not to share these data, or just to share it with selected partners.

On the other hand, EDI is developing among shippers and transport operators, and some of them are setting up EDIFACT standardised messages for their activity (23% of companies which replied to the survey). This development is a big opportunity to harmonise the format of data between players.

Conceptual factors

Shippers, transport operators and other actors in the chain of transport use different concepts and definitions to count their traffic: ITU, container, e.g. 20', 40' ISO or others, TEU, unit of loading, swap body, trailer, e.g. standard or semi-trailer, lorry, wagon, tonnes, 'box', etc. All these units correspond to different sizes and capacities, sometimes they are not standardised. As far as rail transport is concerned, the unit measured was 'traditionally' the wagon. Now, according to the operator considered, it may be wagon or TEU. The consequence is that it is very difficult to build inter-modal data, assuming that these data are not kept confidential.

Combining such heterogeneous data with different units provided by different actors has a big potential risk of errors. The prevention of this risk supposes a huge work of harmonisation. The units used in future data bases should be based on the most usual concepts such as ton or TEU, which are common to a majority of actors.

Confidentiality

This point appears to be a fundamental stumbling block. For commercial reasons, the majority of private companies consider detailed data as confidential. The process of deregulation of the transport sector in form of progressive disappearance of national monopolies has strongly contributed to the increase of the confidentiality behaviour among players of the transport sector, particularly rail and rail-road operators.

- Shippers and road hauliers hesitate to participate in a data collection. They estimate that the data they have is sufficient. They are conscious of the present decrease in data quantity and quality, but they do not want to spend extra cost for producing statistics.
- Port and airport operators are already data providers. They are ready to participate in a data collection process.
- The opinion of the railway operators is more ambiguous. They have to provide data to public authorities, but because of the fierce international competition the quantity / level of detail of data provided is decreasing quickly.

However, the threshold of confidentiality is not an absolute level. It can vary according to the interest an operator may have to provide data:

- The financial interest; in which case the cost to build a comprehensive data base by a private source would be prohibitive.
- The other benefits that the operator can clearly identify, mainly the data it can obtain in exchange. The more valuable data for the firms are a better knowledge of their environment, market share, data on the different existing routes on a specific O/D, etc. The knowledge of the environment is necessary for companies negotiating bank guarantees or grants.
- In addition, the operators need strong guarantees of confidentiality for the data they provide. Professional organisations could be an efficient 'filter' guaranteeing that only aggregated data will be available.

Some items have been identified that are very likely to be confidential:

- Price and cost items
- Detailed transport flows by commodities - if there is a danger that a single company or business relation can be identified
- Cut-off time of transfer points
- Catchment area of transfer points
- Transhipment volume of transfer points (sometimes)

On the other hand, the problem of confidentiality cannot be clearly attributed to certain items. It rather results in a general refusal of a firm to participate in a survey. So here confidentiality is dealt with in terms of the probability to make some information available.

3.7 Evaluation of cost-benefit aspects

The work carried out for the comparative Cost Benefit Analysis (CBA) of a set of options for the implementation of a European Data base on Inter-modal Transport concentrated on two main goals:

- **devising an *ideal* methodological framework** for the comparative evaluation of costs and benefits associated to alternative data collection options; although it is not expected to be directly applicable in its complete form, the existence of such a framework sets a sound basis for further analyses, and guarantees the overall consistency of the approach;
- **comparing the relative merits of alternative scenarios** for the establishment of a European Inter-modal Data base, as identified in the previous InFreDat work packages, each corresponding to a different operational approach to developing the data base.

3.7.1 Methodology

The approach to CBA varies depending on the nature and context of the analysis, and on the availability of reliable data. Typically, the main options are:

- A proper **CBA**, where both costs and benefits are quantitatively evaluated in monetary terms.
- A **Cost Effectiveness Analysis (CEA)**, where the direct quantitative evaluation is limited to the cost side, while benefits are estimated on qualitative scales.
- A **Multi Criteria Analysis (MCA)**, where neither costs nor benefits are directly quantified in monetary terms.

The approach adopted in the contexdt of INFREDAT is based on an enhanced CEA option, in which benefits are estimated on individual scales and a total quality score is computed weighting these different scales. In so doing, the evaluation of benefits is practically made applying multi-criteria concepts, while cost evaluation remains straightforward. However, a significant attempt has been made to provide rough estimates of the monetary value of potential benefits, therefore allowing for a tentative evaluation of the economic viability of data collection options.

3.7.2 Data

Previous project activities within INFREDAT have led to the specification of the full and detailed set of data items to be included in the data base, together with the data sources potentially relevant, and an array of data collection methods to be used for actual implementation purposes. Ideally, cost and benefit data required to proceed are therefore as follows:

- Cost data: elementary costs to be faced when activating each of the relevant combinations between data items, sources, and collection methods. Such relevant combinations have been identified within INFREDAT; see D4, list of publications.
- Benefit data: benefits arising from the availability of the data base. These should be made available according to the differentiation by type of users, where it is expected that e.g. shippers will derive benefits of a different nature and value than those potentially gained by operators, etc., and by data quality factor generating the benefit, e.g. frequency, level of disaggregation, etc.

In practice, and although INFREDAT has produced estimates for most such data, there are severe limitations to the ready availability of direct and reliable figures. This clearly determines a relatively high uncertainty in absolute valuations, which must be carefully considered when proceeding with the final interpretation of results. An original approach to tackle this aspect has been devised, and is illustrated below.

3.7.3 Input from other project work packages

Based on the analysis carried out in other project work packages, data collection options are defined through the association of each *data item* to a *data collection method*; each option clearly ensuring full coverage of all data items. In fact, data items can be grouped in *data categories*, thus reducing the number of combinations. Data categories are homogeneous in terms of data collection method: within the same data category, if a given method is used to collect one particular data item, then all other data items in the same category will also be collected with the same method, as the overall cost of this exercise is the same whether one collects one or more data items; the typical example is access to published statistics, whereby if more than one data item is reported by the same source, that source will then be used for all reported data items, thus resulting in the identification of *modules.* Within the data collection approach, four significant options (each therefore corresponding to a specific combination of *modules*) have been identified. However - and this addresses the second objective mentioned above - the cost benefit calculation process has been designed to allow similar calculations for any given data collection option; defined, as above, as a given combination of *modules*. A data base has then been developed, so that *any* data collection option beyond the four which are explicitly analysed below can theoretically undergo the same evaluation process.

3.7.4 Framework for value assessment

The ultimate goal of developing a European inter-modal transport data base is to contribute to the improvement of the quality of inter-modal transport services. Such improvements can be measured in many ways, e.g. market share, cost competitiveness, door-to-door transport time, etc., the difficulty, however, being to establish a causal – and possibly quantitative – link between: on one hand, the existence of the data base itself and its fruition by the potential users and, on the other, the performances of the inter-modal transport systems. In fact, what is needed to proceed along those lines is a mechanism to estimate the *value* that the data base may have for its potential users. Such value can be conceptually related to the expected increase in the quality of decisions both strategic and operational that the users may experience thanks to the availability of the data base.

Clearly, the data base value will vary with the reliability and completeness of its contents and with the speed and ease of access.

It is therefore necessary to introduce the concept of 'perfect knowledge", corresponding to the maximum (ideal) quality level of the knowledge that users may gain thanks to the availability of information, which is in turn expected to maximise the quality of the decisions taken.

On the other hand, different users categories have differing expectations, owing to the different nature of their activity and objectives, e.g. shippers aim at reducing transport costs while improving performances, operators aim at increasing revenues and operating profits,

public authorities aim at reducing congestion and emissions while increasing the profitability of public investments, etc.

The complexity of the above requires the establishment of a consistent framework for the assessment of the value of perfect knowledge, and of the degree to which specific data collection options approximate such ideal situation.

3.7.5 Value ranking of data collection options

In a first stage the appraisal of the data base value is carried out at a general level, i.e. considering all users as a whole. To this end, a 'scoring mechanism" has been established, whereby each data item (or data category) is analysed with respect to six criteria: i) spatial detail (geographic disaggregation), ii) frequency of data collection, iii) maximum delay (age of data when made available), iv) loading unit detail, v) product detail and vi) data reliability (confidence, representativity). The first five criteria are single data quality characteristics, while the latter is the level of data reliability, which obviously depends from the data collection and processing methods used, and affects the general quality of data. A system of scores is proposed, whereby each data item is valued on relative scales, according to its expected quality. The assumption is that the ideal data base, i.e. ensuring perfect knowledge corresponds to maximum scores for each item. In turn, the score obtained by any given imperfect option provides a measure of the degree to which this particular option approximates perfect knowledge: the higher the score, the closer the option will be to perfect knowledge, and therefore the higher its expected value.

Through a systematic standardisation of scores on a 0-100 scale, options and their variants are then compared. Changes in the values of weights thus further allow to carry out sensitivity tests.

The weighted scoring system thus established then allows to proceed with the value ranking of different options to obtain a complete framework of inter-modal data. Each module within each option can be valued, and a final total score derived for each option, providing a relative measure of the ultimate quality of the data base developed through this option, i.e. the so-called value ranking.

To manage the scoring system in a flexible way, allowing modifications of (standardised) scores and / or weights assigned to the quality criteria, a specific data base application was developed. Practically, through simple queries it is possible to modify some parameters, like individual scores or weights, in the data base, and run new computations of the total quality scores as a consequence. This has also allowed to carry out sensitivity tests in order to measure the relative importance of the values assigned to the various weights.

3.7.6 CEA and CBA of the three alternative scenarios

The scenarios are each identified by a different set of data modules, and cost-effectiveness evaluation was made summing up the costs and quality scores computed for the individual data modules. The cost-benefit analysis was finally performed based on a partial and necessarily approximate identification of potential benefits for selected categories of users. The three scenarios examined are:

- **Basic Scenario**: This scenario is based on statistical, administrative and literary sources and on a wide use of models to estimate coherent missing data.
- **Surveys and Counts Scenario**: This scenario complements the basic information of the previous one with special surveys and counts conducted in selected sets of transfer points, e.g. ports, freight platforms, etc. and transport chains and at fixed time intervals.
- **Tracking & Tracing Scenario**: Additional information collected from special surveys and counts in the previous scenario is substituted by tracking and tracing activities covering the main transfer points and / or transport chains of the European network.

The causal link between the improved availability of data on one hand, and the economic performances of the sector on the other, while quite obvious in qualitative terms, i.e. better information means better decisions, and therefore higher performances, is virtually impossible to appraise quantitatively, considering the current data constraints. Yet, there is a generalised consensus on the need to improve the quality and availability of inter-modal data, and the ultimate objective of the INFREDAT exercise is in fact to identify *the most suitable options* for establishing a European data base on inter-modal transport. This implies that a ranking procedure, although based on quali-quantitative and imperfect data, may still provide useful input in view of the identification of the best way forward.

The ordering of modules of the scenarios by cost/effectiveness ratio may help to design a gradual strategy for the actual implementation of an European inter-modal data base, based on the simple principle that 'easier' in the meaning of most cost effective modules should be developed first.

3.7.7 Basic Scenario

Table 3-19: Basic Scenario

Modules	Total weighted score	Total yearly cost (Euro)	C/E ratio (Euro per score unit)	Cumulate quality score	Cumulate costs (Euro)
2.3 Transfer points	140,1	6.300	45	140	6.300
2.1-1 Basic networks	126,8	5.800	46	267	12.100
2.2 Transfer points	52,9	6.300	119	320	18.400
2.5 Transport chain structure	262,0	34.400	131	582	52.800
1.1 General statistics	118,8	16.800	141	701	69.600
2.1-2 Transfer points	52,5	16.300	310	753	85.900
2.1-3 Inter-modal transport services	35,3	16.400	465	788	102.300
2.4 Inter-modal transport volumes	13,1	11.400	870	801	113.700
1.2 Inter-modal transport statistics	16,0	15.800	988	817	129.500
2.6 Inter-modal transport performance	18,2	47.580	2.614	836	177.080
TOTAL	**836,0**	**177.080**	**212**		

In the first two positions of the table above are structural supply side data relative to physical capacities and services of networks and transfer points, like ports or freight platforms, usually available with a good level of detail and with low frequency requirements, which contribute to

reduce the yearly maintenance costs. The third module concerns demand side data of transfer points, like traffic and catchment areas, which are easier to extract - as compared with network traffic data - from current studies and data bases. A sound cost/effectiveness ratio is achieved also with the module 'Transport chain structure', which extensively uses modelling frameworks already developed in the context of EU research projects: the module is expensive, because costs include updating and estimation procedures, but the results are valuable. The fifth module of the list intends to exploit the already consolidated statistical data bases of Eurostat, characterised by relatively high cost of data updating but also supplying a wide range of reliable data, which enhance the quality score. Finally, all remaining modules show a cost/effectiveness ratio higher than the scenario average. This regards data sets which require a more substantial work of data collection, organisation, and estimation from the current sources and models, with relative poor results in terms of quality scores.

The main limit of the basic scenario, which is the less expensive in absolute and relative (to the quality score) terms is actually the poor performance of these modules, which concern more specifically inter-modal data, that is the core information of the inter-modal data base.

3.7.8 Surveys and Counts Scenario

Table 3-20: Survey and Counts Scenario

Modules	Total weighted score	Total yearly cost (Euro)	C/E ratio (Euro per score unit)	Cumulate quality score	Cumulate costs (Euro)
2.3 Transfer points	140	6.300	45	140	6.300
2.1 Basic networks	127	5.800	46	267	12.100
2.2 Transfer points	53	6.300	119	320	18.400
3.1 Transfer points	78	9.700	124	398	28.100
2.5 Transport chain structure	262	34.400	131	660	62.500
1.1 General statistics	119	16.800	141	779	79.300
3.4 Inter-modal transport volume	22	4.907	225	801	84.207
3.6 Transport chain structure	203	51.583	254	1.004	135.790
2.1 Transfer points	53	16.300	310	1.057	152.090
2.1 Inter-modal transport services	35	16.400	465	1.092	168.490
3.5 Transport chain structure	200	118.033	591	1.292	286.524
2.4 Inter-modal transport volumes	13	11.400	870	1.305	297.924
3.2 Transfer points	55	51.583	940	1.360	349.507
1.2 Inter-modal transport statistics	16	15.800	988	1.376	365.307
2.6 Inter-modal transport performance	18	47.580	2.614	1.394	412.887
TOTAL	**1.394**	**412.887**	**296**		

Surveys and counts could be carried out in fixed periods in a way that all relevant data, parameters, and models are checked and improved in fixed intervals, e.g. every 3 years. Therefore, the data from surveys and counts will not be used to expand the data to total, but to describe structures and their change in the course of time.

The first three modules of the Surveys Scenario are the same of the Basic one, and same comments apply; see above. The fourth module is a new one: it concerns additional surveys to be made on a sample base every 3 years, which is a suggestion to reduce the yearly cost substantially, to collect supply side transfer points data. Also the fifth module is a new one, and it aims to gather transport chain data directly from sample surveys: the module is expensive, because of the costs of surveys campaigns, but also the results are valuable (quality score 262). The following three modules in the list show a cost/effectiveness ratio below the scenario average (296 Euro), addressing in some case core categories of inter-modal transport data: in particular, Module 3.4 envisages a survey of inter-modal transport volumes and costs. Finally, the remaining seven modules are essential to complete the information on inter-modal transport volumes and performance, and to gather transport chain data directly from surveys. However, their performances are relatively poor. Transport chain data surveys will assure an adequate coverage, as witnessed by the relatively high quality score (200 points), but with big cost efforts.

The Surveys Scenario allows partially to offset the main limit of the basic scenario, thanks to its focus on inter-modal data and the gathering of fresh information from surveys and counts.

3.7.9 Tracking & Tracing Scenario

Table 3-21: **Tracking & Tracing Scenario**

Modules	Total weighted score	Total yearly cost (Euro)	C/E ratio (Euro per score unit)	Cumulate quality score	Cumulate costs (Euro)
2.3 Transfer points	140	6.300	45	140	6.300
2.1 Basic networks	127	5.800	46	267	12.100
3.7 Transport chain structure	600	32.750	55	867	44.850
4.1 Inter-modal transport performance	400	46.800	117	1.267	91.650
3.1 Transfer points	78	9.700	124	1.345	101.350
1.1 General Statistics	119	16.800	141	1.464	118.150
3.3 Transfer points	200	32.750	164	1.664	150.900
3.4 Inter-modal transport volume	22	4.907	225	1.686	155.807
2.1 Transfer points	53	16.300	310	1.738	172.107
2.1 Inter-modal transport services	35	16.400	465	1.774	188.507
2.4 Inter-modal transport volumes	13	11.400	870	1.787	199.907
1.2 Inter-modal transport statistics	16	15.800	988	1.803	215.707
TOTAL	**1.803**	**215.707**	**120**		

In this scenario, only additional labour costs and marginal investment costs of tracking and tracing operations have been considered, assuming that forms of Automatic Equipment Identification (AEI) are already installed and operational for wider purposes than strictly the collection of statistical information. In particular, the marginal investment cost has been assumed equal to the cost of minimal equipment for 150 Inter-modal Transport Unit (ITU), i.e. 18.750 Euro per year (estimation), although the data collection is considered to be based on a more consistent equipment of 8.000 ITU, whose costs should be already absorbed by the current transport operations. Finally, the scenario implicitly assumes that all the (relevant) confidentiality problems are solved, allowing to produce also sufficient product details.

With these rather optimistic assumptions, it is not surprising to see in third position the module 3.7: tracking and tracing of transport chain data, with an optimal ratio cost/quality score (the latter attains an absolute maximum: 600 points). The first two modules are the same of the Basic one, and same comments apply; see above. The fourth module is a new one, and it aims to extract performance indicators of inter-modal traffic from the current EDI applications: it is relatively affordable, because it exploits the already existent systems of inter-modal operators, although substantial confidentiality problems might hinder its actual feasibility. All the other modules show a cost/effectiveness ratio above the scenario average (120 Euro). They include in particular surveys on inter-modal transport volumes and costs, like Module 3.4, and on transfer points, like Module 3.1, which are both relatively expensive, and poor in terms of results (quality scores), as well as the application of T&T technologies to the simple monitoring of traffic data, without product detail, at transfer points, like Module 3.3.

Figure 3-11: Basic Scenario: Sequence of modules by order of CE ratio

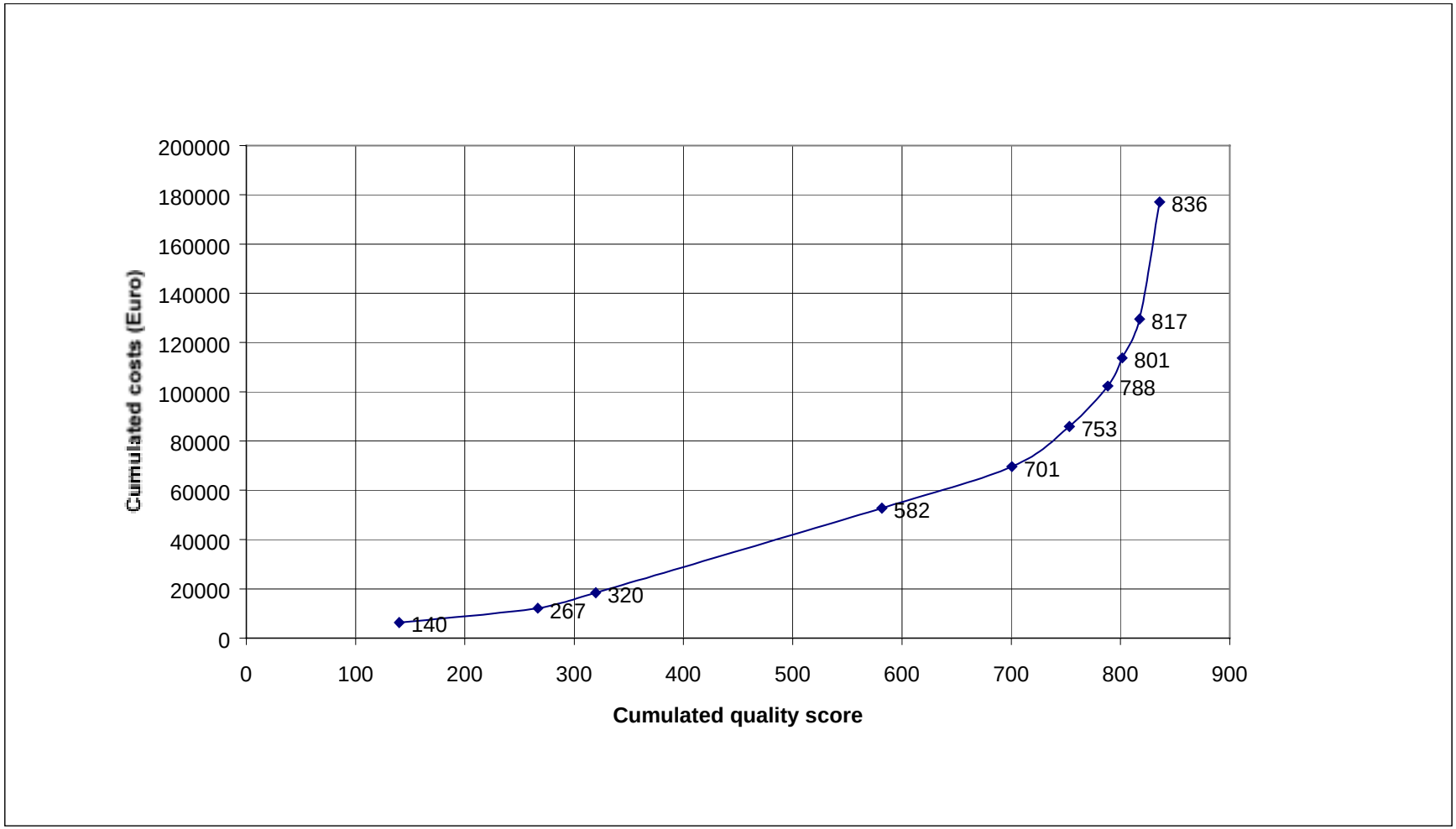


Figure 3-12: Surveys and Counts Scenario: Sequence of modules by order of CE ratio

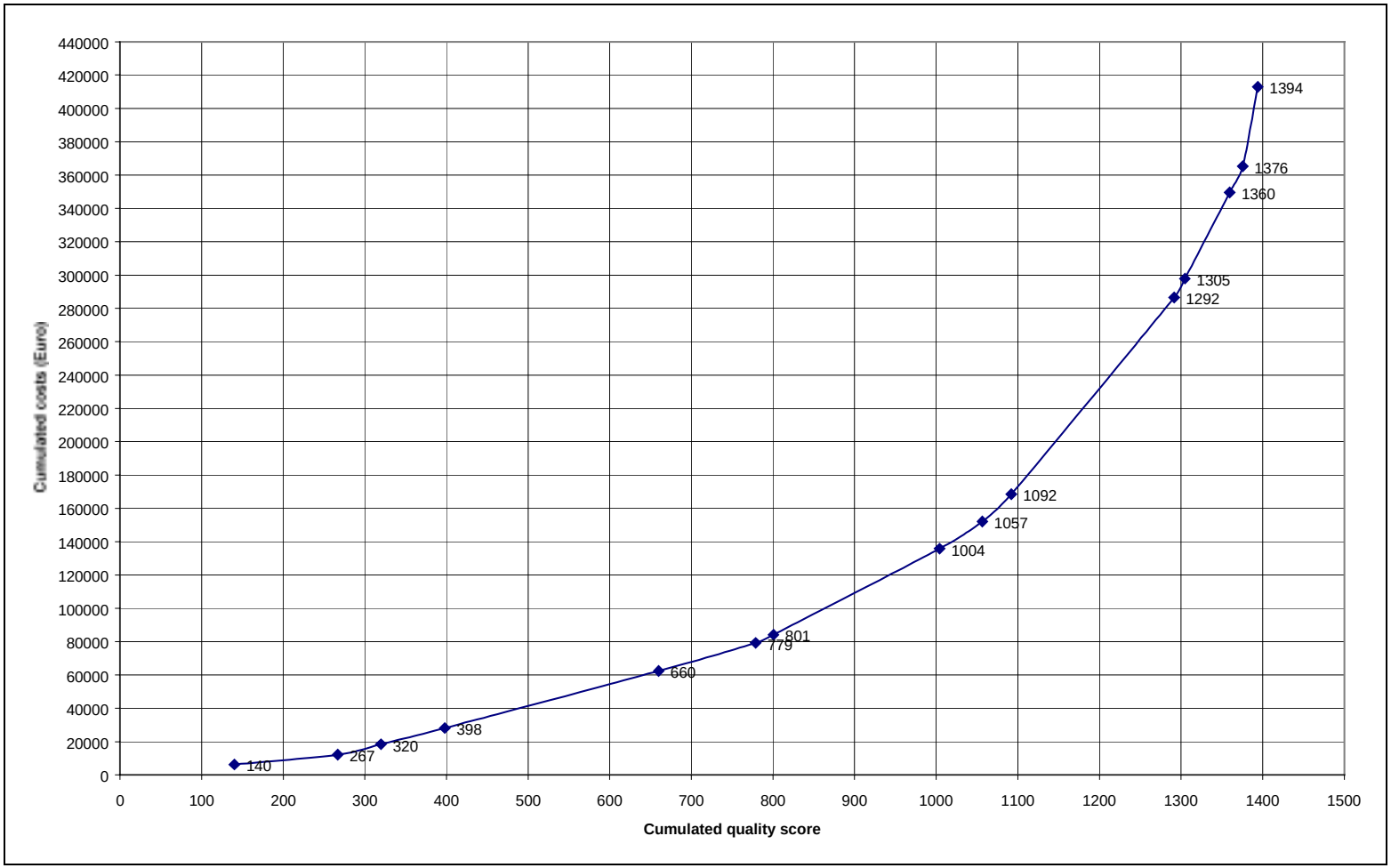


Figure 3-13: Tracking and Tracing Scenario: Sequence of modules by order of CE ratio

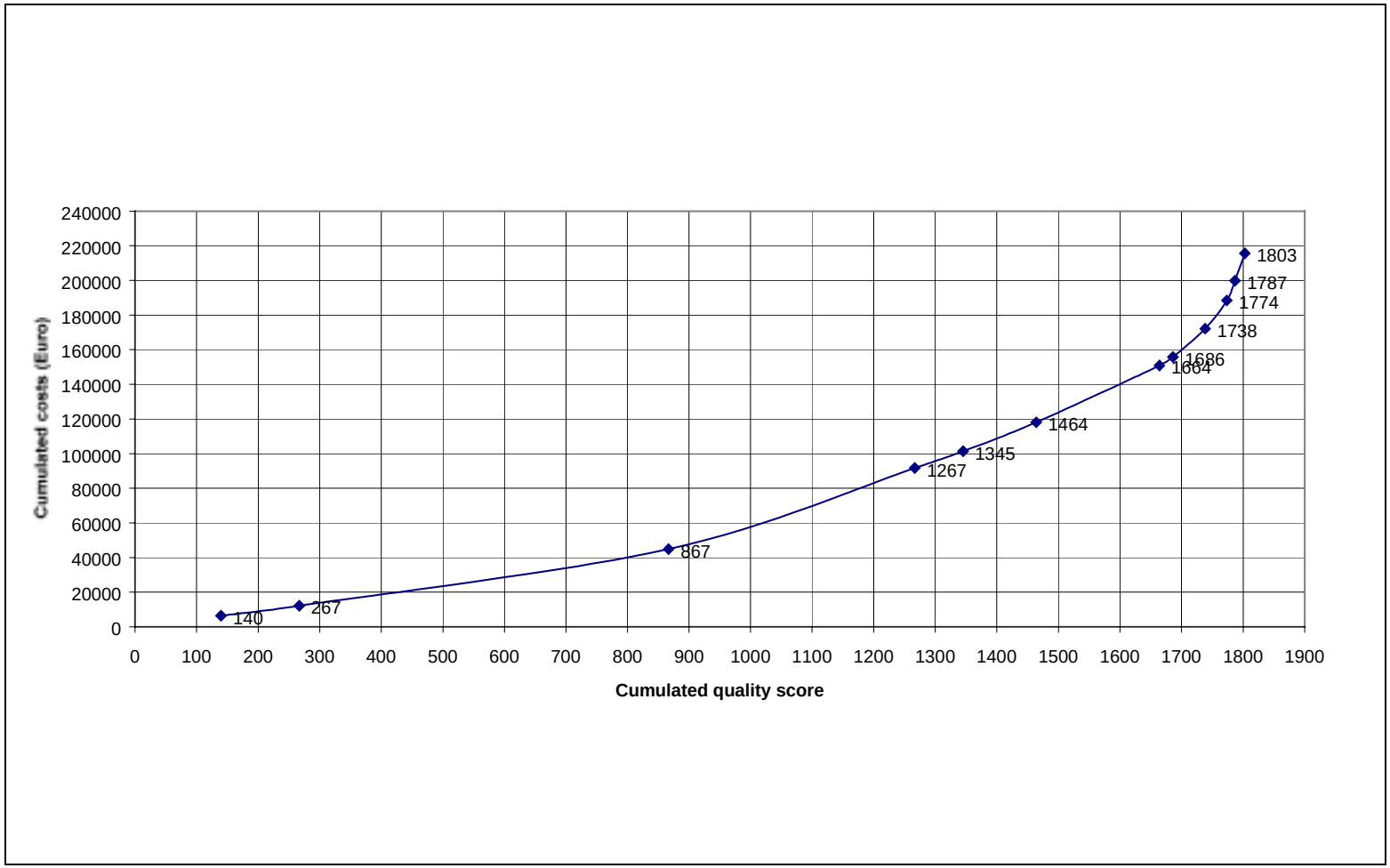
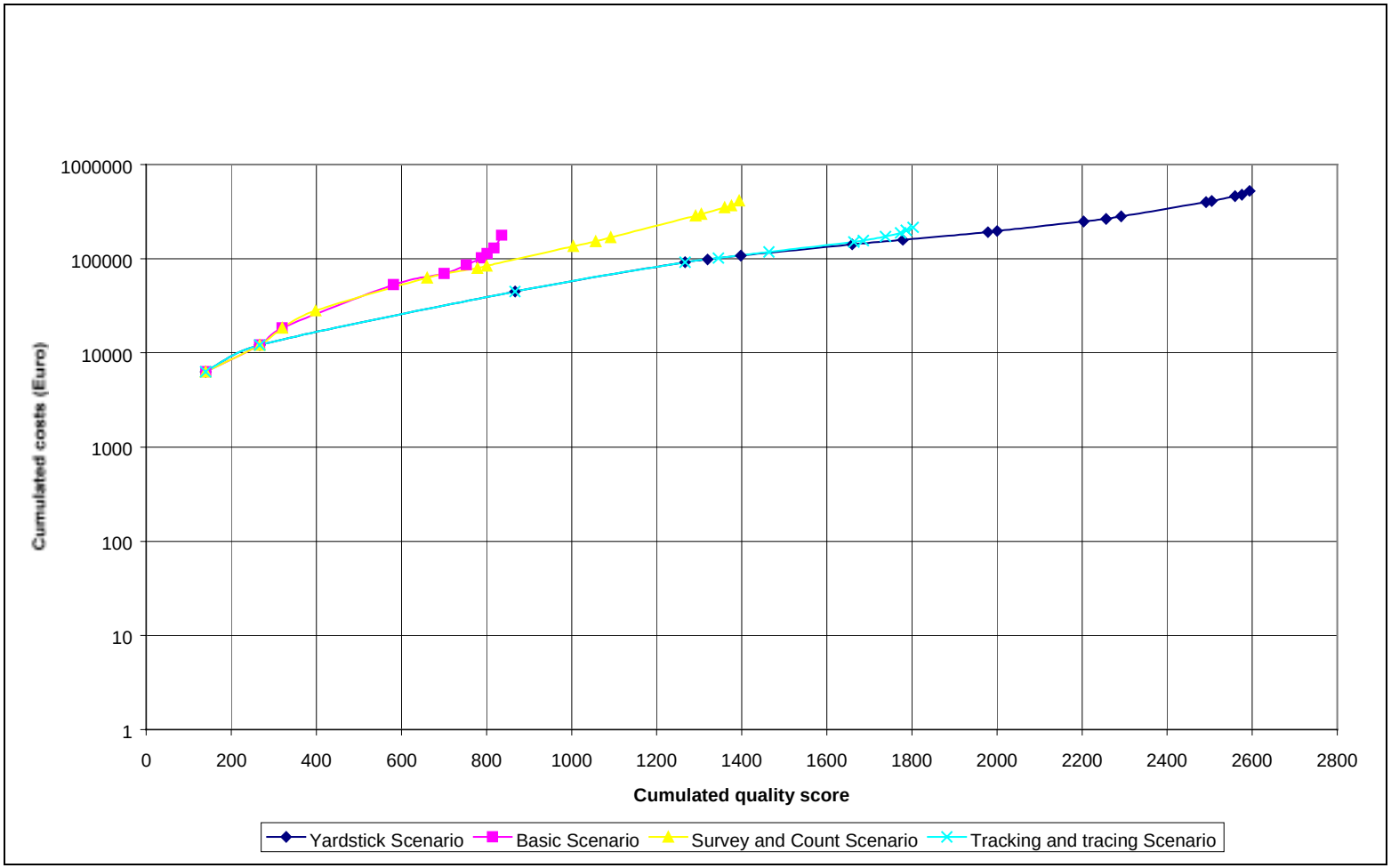


Figure 3-14: Comparison of scenarios



3.7.10 Conclusions on scenario comparison

Comparing the different scenarios, the following conclusions can be drawn:

- The Basic Scenario is cheaper (177.080 Euro), as it is composed of 10 modules which do not include costly surveys and counts activities, but it also has the lower cumulate quality score (836 points) and a very scarce value of information (836/8.800 = 0,095). For this reason, the cost/effectiveness ratio is relatively high: 212 Euro per score unit.
- The additional five modules of the Surveys and Counts Scenario generate a substantial increase of costs – from 177.080 to 412.887 Euro (+ 133%) – without an equal increment of the quality of information produced. In fact, the cumulate quality score grows to 1.394 points, but this represents only an increment of 67% on the cumulate score obtained with the basic scenario. As a result, the cost/effectiveness ratio attains the maximum level: 296 Euro per score unit.
- Finally, in the Tracking and Tracing Scenario very optimistic assumptions were made: the most costly surveys and counts modules were partially substituted by the exploitation of tracking and tracing activities. These are supposed to be currently performed for other (operational) purposes, and only the marginal costs of feeding the inter-modal data base with permanent statistics is charged. Moreover, data collected with T&T technologies are assumed to include a sufficient product detail, taking for granted that all the confidentiality problems will be solved. In this way, the tracking and tracing scenario is clearly the most effective: it produces a cumulate quality score of 1.803 points at a total cost of 215.707 Euro, giving a cost/effectiveness ratio equal to 120 Euro per score unit, well below the 'yardstick' scenario average (202 points per score unit). However, the rather optimistic conditions which should render really feasible this scenario, including the overcoming of confidentiality barriers, are difficult to achieve, at least in the near future.

Sensitivity tests have been performed to contrast the different perception of data quality depending from different users needs, i.e. public policy makers do not require some data at the same level of detail than operators, changing coherently the scores assigned to the various data items, and this exercise has clearly demonstrated the overall consistency and inherent stability of the ranking method proposed.

3.8 Dissemination activities

Both dissemination activities and integration of third parties have been an integral part within the INFREDAT project. During the project lifetime in all project phases activities supporting this task were undertaken. In particular three areas of dissemination and integration were identified as important.

3.8.1 Advisory Committee

Inter-modal transport projects previously carried out by the InFreDat partners led to contacts with representatives of the inter-modal transport industry. So the idea of involving them into the Advisory Committee (AC) arose, establishing a connection between theoretical and practical side of the project.

The core members supporting the AC were recruited as a result of personal relations between them and representatives of the project partners. Further potential members had been identified in order to consider a representative selection of inter-modal transport actors.

The final AC consisted of companies, organisations and associations from operational, scientific and technical areas as well as representatives of users groups. A list of the AC members can be found in the annex. The members of the AC provided specialist advice to the project, and in particular to work package leaders, to ensure the practical relevance of the work package outcomes and the possibility to use the results in a future day-to-day environment. The AC did not exercise executive action over the work package leaders, but they advised the scientific and technical project management. From consortium side, the AC was appraised as potential starting point for further joint activities of relevant actors in the inter-modal transport market, which have been brought together within this project as a first step. However, future common activities of AC representatives cannot be developed after the project finalisation.

To perform this task, the representatives of the AC were asked to participate in three workshops. Additionally, individual members of the AC were asked to give advice to specific items related to their individual knowledge and experience. During the project lifetime three joint workshops of the AC and the project partners took place in Brussels. They were held on 16. March 1999, 29. October 1999 and 29. February 2000. Results of these workshops and comments on the project findings are integrated in the particular chapters.

The third and final workshop was executed as a final dissemination activity to present the final results of the study and to discuss the possible transfer into practice.

3.8.2 INFREDAT – Project flyer

The general intention of the flyer was to inform all potentially interested parties outside the project as well as outside of EC research activities. In particular, the flyer was meant for politicians, decision makers and policy makers of the national governments, the competent administrations, and the operators.

In fact, the distribution of the flyer had two main purposes. The first aim was to attract persons involved in the inter-modal transport market in order to obtain a representative selection for the AC. The flyer was also used to inform interview partners about the project's background and encourage them to attend AC meetings. For this purpose, the flyer was the main information source sent to potential AC members. The second aim was to inform a broad public about the project, so the flyer was distributed widely to reach different target-groups and draw their attention to the project. For this purpose the flyer was distributed to participants of the Transport Research Conference, Lille, 8.-9. November 1999 and to representatives of Greek transport and traffic organisations / institutions selected by the project partner Systema. Additionally, the flyer was available for downloading from the project home-page.

The contents of the project flyer consisted of an introduction to the project and a description of its objectives and expected results. Furthermore, the approach was given using a schematic drawing showing the interdependencies of the work packages. A time schedule showing the start and close dates of the single work packages was also provided. Members of the Advisory Committee were listed, representing the wide range of institutions / organisations involved in inter-modal transport and their respective contact details provided. At the end of the flyer the project web-page address is mentioned as well as the contact details of the project co-ordinator. The flyer comprised four pages.

3.8.3 INFREDAT – Project web-page

An internet web-page, which was used as project home-page, was created by PTV and established on their company server. The intention of the home-page was to inform every potential web-user about the project, but in particular it was meant to inform persons in detail about the project who had seen the InFreDat flyer or knew of the page through an announcement of one of the workshops, or the article on the EIA web-page.

The existence of the project home-page was advertised in the InFreDat project flyer, in information letters sent to the AC members, and by hyper-links to / from the project partners home-pages and a particular co-operation with the European Intermodal Association (EIA).

In addition to general project information, links to related projects, the presentation of the interim results and the latest project news as well as a discussion forum for interested parties have been created. The intention was to stimulate the exchange of opinions and information between all persons involved in the project and between project related persons and those outside the project. To start a discussion or an exchange of views, questions and statements were initiated by the consortium members. Unfortunately, the discussion forum was not used by third parties in form of contributions. A reason might be the discussion forum being redundant to the AC workshops, where statements and questions could be discussed and answered directly from participant to participant. Another reason might be too much transparency in a way that the authors name is required to publish the contribution.

Recommendations and conclusions elaborated as part of the same work package are summarised in chapter 4.

4 Conclusions and recommendations

In summary, the results of the INFREDAT project provide a comprehensive insight in the present data needs and data availability in the context of inter-modal freight transport, considering also possible future data sources and IT-based data collection methodologies. The conceptual work has been verified by applying three real transport pilot cases.

The main elements of the 'data collection methodology' are the description of how a complete data base structure has to be defined and a data model for estimation and forecast for missing or future data need to be developed, and, in concrete, which data have to be collected and how to fill the data base structure proposed. On the basis of a cost/benefit – cost/effectiveness analysis, the collection methods are ranked according to their cost/effectiveness ratio and recommendations for the sequence of implementation of different collection methods is given.

Further relevant findings have been identified with the help of the three pilot case studies and during discussions with members of the Advisory Committee. Complementary to the elaboration of the consortium partners, discussions were held with representatives of the different user groups, both from the transport market side as well as from the policy side, on national and on European level. Discussions were held and contributions were given particularly on aspects such as:

- Data needs by user groups
- General data availability
- Potential benefits and advantages by a European wide inter-modal data base
- Existing data basis and problem of data comparability
- Data confidentiality
- Organisation of data collection and processing by EC / Eurostat vs. by a private organisation
- Aspects concerning data collection, such as:
  - Data quality
  - Time intervals for data collection
  - Use of advanced IT-solutions, i.e. T&T, EDI
- Cost aspects

Getting a better insight in the motivation of professional actors to participate in the building of an inter-modal freight data base, the provision of concrete views of possible ways forward in specific case studies of European corridors and types of commodities, or the definition of a methodology for supplying a cost effectiveness analysis to different scenarios of inter-modal data collection were mentioned by different AC members as additional beneficial results from the discussions.

In continuation of the INFREDAT project and on the basis of its results, the actual realisation of the proposed methodology is required. Here, the willingness of transport market actors to contribute to the building of an inter-modal freight data base and, closely related to this, the issue of data confidentiality or, the other way round, the breaking point for the operators to support the data collection, will be key for the success of the realisation of the data collection

approach. These aspects needs to be solved with highest priority in the context of the realisation of the data collection approach.

4.1 Next steps for the realisation of an inter-modal freight transport data base

The final recommendation is not to develop different scenarios for the collection process but to provide a system of methodologies that come up to the data users' expectations. The most important data users will be the 'Public Sector', especially the European Commission, Eurostat and the national governments. Therefore, the collection approach must suit the data needs of these users. The appropriate method is defined in form of a Basic Scenario. The Surveys and Counts Scenario is a supplement to the Basic Scenario in order to improve the data and to recalibrate the parameters and models due to time dependent structural changes. Both Basic Scenario and Surveys and Counts, which together perform a **method for permanent data collection**, need a well defined organisation of data collection and data processing. It is recommended that the responsibility for the organisation and data processing lies on the Public Sector, and it has to be centralised.

The following table identifies the steps to be taken to start realising the methodological approach elaborated.

Table 4-1: Next steps for the realisation

Decision and definition	
Decision about organisational and administration of data collection and processing	• directly by the Commission • via member states bodies • based on a contract by a consultant / institute
Definition of geographical coverage	• European-wide • selected countries • specific corridors
Development and implementation	
Physical implementation of data base structure (considering ETIS)	
Development of model for estimation of data gaps and forecast	
Data collection, processing and modelling	
Identification of data providers (by name)	• depending on geographical area • depending on data accessibility (confidentiality)
Decision on physical data collection / transfer	• depending on data structure • depending on data availability • depending on cost aspects
Conduction of data collection	• appropriate sample size • frequency of data collection
Data processing and modelling	• depending on data available and data model for estimation and forecast selected

The success of the completion of an inter-modal freight transport data base using the data collection approach proposed will clearly depend on some key factors:

- Restriction to some relevant questions of core users (public sector)
- Involvement of key data providers (mainly forwarders, shippers, logistics operators)
- Intervals for data collection by surveys or counts more than one year
- Questionnaires / interviews for data collection simple and not too extensive

On the basis of the INFREDAT results, the Commission is recommended to start a consultation process with companies and with corresponding professional associations being ready to participate in a data collection test, e.g. members of INFREDAT Advisory Committee.

Data collection approach

INFREDAT provides the solution for a data collection method as the principle framework for the establishment of a data base for inter-modal freight transport data considering the requirements of the most significant users. Therefore, recommendations for a specific INFREDAT data collection approach are worked out.

A first level of the scenario – called **Basic Scenario** – builds the kernel of the methodology for the collection of inter-modal freight transport data across Europe. The characteristics of the Basic Scenario are:

1. All the necessary data comes from statistics, publications, internet-research etc.
2. The missing but necessary data have to be estimated by a specific model.
3. The Basic Scenario allows quick initial results, could be established soon and is a long-term solution.
4. Collection and processing of data can be administered directly by the European Commission (EUROSTAT) or by contract with a private company.
5. The quality of data meets the needs of the primary user, the political authorities.

In addition to the Basic Scenario, **surveys and traffic counts** need to be carried out to improve the data and the model for the Basic Scenario. The characteristics of the Survey and Counts Scenario are:

1. The Basic Scenario remains unchanged.
2. The Survey and Counts Scenario is used to provide additional information in order to improve the data, parameters and the model.
3. The responsibility for the data collection remains with the 'Public Sector'. Otherwise there is no guarantee that the data will be available. This may need a directive or a legal act.
4. The additional data could provide further benefits to other users of the data base, because surveys and counts give a more detailed insight into the structure of the inter-modal transport market.

The surveys and counts could be carried out at fixed intervals in order to check or recalibrate all relevant data, parameters, and models. Thus, the design of the Basic Scenario has three fundamental components:

1. **Direct sources**: Data collection from directly available sources **every year**
2. **Interviews**: Data collection from interviews **every 3 years**
3. **Counts**: Data collection from counts **every 5 years**

This Basic Scenario for a workable data collection approach for INFREDAT respond to the data needs of the most important users of the inter-modal data base and is flexible enough to extensions of data needs, data sources, or data transfer methods.

In future, **advanced IT solutions** such as Tracking and Tracing or EDI might be used first to complete and in long term possibly to replace some of the collection methods mentioned above. Today, T&T only provides a specific view of inter-modal transport data which is not sufficient for the INFREDAT data base. On the other hand, the actual and future potential of T&T as data collection approach is not fully known. In the frame of an INFREDAT continuation it could be useful to develop a specific view or extract of the data produced by T&T. E.g. if there is some information from an AEI (Automatic Equipment Identification) method available, these data can be used to describe the transport chain of an ITU. In combination with data from other sources, e.g. trade data, and estimated data from the model one can produce the needed results for INFREDAT.

Some conclusions with respect to the data collection approach can be drawn:

- The data requests for inter-modal data and different potential users of the data base require a **flexible data collection approach**.
- Moreover, the approach must be flexible enough **to include future developments of data collection methods,** like internet research, tracking and tracing of loading units etc.
- Not all needed data are observable; therefore the data collection approach provides input **data for an INFREDAT model** where data gaps of an inter-modal data base can be filled by design of required data.
- It has been shown that there is a great variety of possible data collection approaches. A recommendation for a practicable solution, which meets several requirements, is the Basic Scenario.
- There are different ways to design the Basic Scenario due to collection methods and sample sizes for interviews, counts, etc. This determines firstly the level of detail of the data, secondly the sampling error and the estimation error, and in consequence the quality of data.
- The use of a specific design of the Basic Scenario therefore provides a **complete data set of needed inter-modal transport data**, but with a specific level of detail and data quality.
- To establish the Basic Scenario for data collection, a decision about the **conditions and administration of the data collection process** is needed.

The most realistic and recommended approach suggested by the results of the cost effectiveness analysis is to follow a gradual path of implementation, in which a first step is devoted to develop and consolidate the modules of the basic scenario, i.e. statistical and other sources, and a second step adds systematic sample surveys and counts to further consolidate the data base every 3 years.

This should be made for all the span of time that is needed to allow the new tracking and tracing technologies to take off and provide their services to the data base, i.e. systematic feeding of data partially in substitution of surveys and counts activities, which could then realistically be charged at acceptable marginal costs, while the current full costs of these technologies is not deemed affordable.

The project decided to describe this specific data collection approach. Considering the project follow-up, the tendency to put this in force should be higher than if there are many alternatives and no decision is made for going straightforward.

Additional data sources

A majority of the existing data and information sources are still related to one mode. Despite this fact, it should be possible, for a given flow defined by the nature of goods and the O/D, to collect basic inter-modal information at various steps of the transport chain, and then to consolidate it. A positive point is that the indicators used by the various sources of information are rather homogeneous: NST nomenclature, number of TEU.

Shippers may provide the destinations, i.e. in % of the total tonnage they carry, the frequency of shipments, as well as the transport times and costs. Moreover, if they manage themselves the transport, they will provide also the pictures of the main inter-modal transport chains, the % of tonnage sent through each chain, as well as the transport time and cost of each segment for each chain.

Logistics operators will provide information about the logistics of the trip chains, for a given O/D and a given nature of goods.

Transport operators will provide useful data on flows at the transfer points, from one mode to another.

Nodal points operators, ports mainly, are priority contacts. They will play a growing role in the future. However, those which produce real inter-modal data, like flows in and out, are still the exception.

Professional associations, like the ones of transport operators and / or of producers by sector, can play two complementary roles: firstly, they can provide aggregated flow data. Although being not inter-modal, such data can be used to set-up the framework of the O/D flow analysis. Secondly, they can act as intermediates ('filters') between operators, shippers, or forwarders and the organisation in charge of inter-modal data collection.

The data available through ports and railway operators are already structured in statistical systems. They could be a starting point for a future inter-modal data base, provided that (increasing) confidentiality constraints are overcome. Data coming from the other players will enrich the system.

4.2 Specific recommendations and conclusions on key issues

ETIS context

A European Transport Information System for Policy Support (ETIS), in addition to what a transport data base can offer, must be able to:

- monitor important policy issues and relate them to specific quantities and indicators, which are needed for taking the correct decisions in regard to these policy issues;
- provide access to the specific transport (or any other kind of) information, which is necessary in order to compute the aforementioned quantities and indicators,
- specifically:
  - provide the links of the policy issues to the transport variables, i.e. the way the quantities and indicators, which are needed for decision support, can be computed from the transport variables;
  - provide access to the actual transport data need for this operation;
  - provide the necessary processing methods for producing the desired indicators and the models for testing hypotheses and performing simulations and predictions;
- through an intelligent user interface, provide adequate guidance for the users, as far as the proper use of the data, the processing methods and the models are concerned, as well as provide assisted access to any related documentation and regulation.

In the INFOSTAT and MESUDEMO projects, basic principles and concepts for an ETIS have been introduced. Moreover, through several concerted activities, CONCERTO has gathered and consolidated relevant information from other projects of the 4th Framework.

In this context, the data model and data base structure developed in INFREDAT has to become part of this ETIS.

Consideration of Central & Eastern European Countries

In particular with respect to a future European wide transport data base, the transport markets of the Accession Countries, their data needs, if different, their particularities, and their past and present statistical systems need to be taken into account. As long as these countries are not members of the European Union, the main source for transport data are the customs. On this basis, statistical data are relatively easy to obtain. In future, this source might disappear and the specific conditions of these transport markets and statistical systems need to be incorporated into the existing EU system. Due to the limited resources this specific aspect could not be tackled in detail within INFREDAT, whereas it is relevant to be highlighted as a relevant issue over the next decade.

Responsibility for data collection process

According to the opinion of the members of the Advisory Committee, the responsibility should certainly be given to the Commission, with specific agreements with member states for the part of information to be provided by them, shipper's survey for instance. The processing and merging of data of different sources and type is complex and should be either done by a technical public unit or by a sub-contractor such as a research institute or consultancy.

Readiness to participate in a data collection process

A majority of the companies interviewed consider that they have already the data they need, in particular operational data, complemented by some key macro-economic data.

But, it is likely that interviewees do not have a good perception of the benefits that would result from additional data. Moreover, a lot of them are conscious of the decrease in quality and quantity of statistical data available in Europe. They agree that there is a mutual interest in improving statistics, and a majority is available to be involved in a process of data collection.

It should be also pointed-out that during the interviews, a majority of interviewees agreed to provide data, although at an aggregated level, concerning their activity on the pilot case study considered.

The results of a project recently carried-out on behalf of Eurostat in 1998-99 highlight the practical limits of the participation of companies in a 'bottom-up approach'. The method applied gave good results for the traffic generated by the port. However, it showed the difficulty in generalising such a system, because of confidentiality reasons. As an example, the combined transport operators, who agreed to provide data for a small sample of traffic, do not seem ready to provide detailed data about their whole traffic, on an annual or monthly basis for instance.

The use of a penalty system to force transport companies to provide relevant data in repeating intervals in form of reports or completing a questionnaire is not considered as an appropriate solution. Despite penalties, some large companies like United Parcel Service (UPS) or Deutsche Post AG (in Germany), refuse to transmit any data to the responsible organisation (Bundesamt für Güterverkehr). Other companies provide (obviously) wrong data (e.g. figures are never above / below legal limits or restrictions). In other countries, e.g. France, the use of penalties is possible, but the application costs of the penalty system are estimated higher than the additional results achieved.

Data confidentiality

The problem of data confidentiality has to be tackled in priority. Indeed, for all three pilot cases and in response by the members of the Advisory Committee, this problem appears very sensitive when discussing with commercial players, like shippers, forwarders, transport operators and nodal point operators. Although, they are open to discussion, companies are reluctant to provide data, because there is currently no 'official' and precise framework guaranteeing this confidentiality. Moreover, this 'sensitivity' of the economic players to data confidentiality is very contrasted, even within a given activity. For example, a railway operator will be less reluctant to exchange traffic data, for a given country, if he is in the position of a challenger than if he is leader on its market.

But, the threshold of confidentiality is not an absolute level. I.e. the willingness to give information in terms of

- interviews / filling questionnaires
- allowing tracking / tracing for external use
- delivering data concerning transport performance

can vary with the conditions which the addressed firms face when they are asked to provide information. The probability of willingness to deliver information grows according to the

- guaranteed neutrality of the organisation which carries out the interviews, in particular no business interest in the transport market;
- credibility of guarantees offered by the interviewers or statistical organisations. Such guarantees can be

  1. to show that no specific characteristics of the firm such as turnover, number of employees, specific regional origins / destinations of transports are surveyed.
  2. to prove that there is no link between surveyed firms on the one hand and regional inter-modal transport volumes or general transport chain structures on the other hand.

- offering mutual benefits for the firms interviewed. Many firms interviewed within INFREDAT requested some type of feedback as a condition of participating in a survey. Due to the macro-economic character of aggregated transport data, it is usually difficult to offer benefits to interviewed firms who are interested in operational, i.e. micro-economic, data. 56 % of the firms interviewed stated that the statistical data available at present fulfil their information requirements. On the other hand, a remarkable proportion (41 %) conceded that they were prepared to co-operate with consultants and statistics offices to improve the quality of data. A majority of the interviewees felt that the quality and accuracy of statistical data is decreasing. Firms need information about

  1. their business environment,
  2. market volume and market shares of certain commodities or on certain routes,
  3. different routes for similar O/D relations,
  4. planned infrastructure projects

  and also about

  1. transport flows by modes and commodities between regions or countries,
  2. first origin and final destination of goods, and
  3. hinterland transport modes of sea-borne transports

  some of which will possibly be provided by an inter-modal transport data base.

When there is really no possibility of mutual data exchange as an advantage for the interviewed firm, negotiating an interview fee could be another option.

- Clarity and comprehensibility of the questionnaire: Restricting the survey to relatively few essential items raises the goodwill of the interviewees as well as providing a clear structure of the questionnaire that is easy to understand.
- Quality of public relations: When surveys are publicised, attempts have to be made to show the importance of a good data base for the quality of transport planning and transport policy.

It must also be pointed-out that, in several other sectors of activity, the situation has evolved in a different, more positive way, for example:

- In the field of air transport, large air passenger carriers know the loading factor and the tariffs of their competitors.
- In the USA, the American Association of Railways collects detailed data on its members and publishes a data base.

The strategy of these companies consists to exchange information with competitors, because they feel it as source of mutual benefit. They are not competing in the field of strict market data, but in the fields of marketing innovation, the quality of service and costs reduction.

In general, the project findings as well as other recent experiences in carrying out surveys and interviews lead to the conclusions that

- it is possible to get inter-modal transport data from surveys / interviews. Therefore the data collection modules containing surveys can be kept as part of the data collection options.
- it is impossible to forecast which items of a questionnaire will have poor responses. Eventual data gaps have to be filled by modelling. Such data gaps also arise if the data collection method 'publications, web-sites', which has no confidentiality problems, is applied.
- the above mentioned measures are suitable for reducing the problem of confidentiality.

In addition to these conclusions, there is the possibility of establishing a legal basis for collecting data through surveys or monitoring centres by the EC.

Overall, it is clear that a wide majority of value added inter-modal transport data is collected, but not presently available to external users, because of confidentiality reasons.

How to overcome the discrepancies of formats?

Particular attention has to be paid to the format of data collected by shippers and transport operators. They collect and produce data according to their day-to-day activity, concerning one given shipment. For one and the same shipment, the information collected by each player of the chain of transport generally differs, for example the shippers collect the exact nature of a good with its detailed specification, while the transport operator uses a more general description, and sometimes only the weight. But also the comparability of data for the same transport operation might differ depending on the data collection behaviour of the transport operator, e.g., UIRR companies collect terminal to terminal data, whereas CNC, new member of UIRR, collects door-to-door data which makes the UIRR internal statistics incomparable. Utilisation of these data suppose a work of harmonisation of the information system. This work can be done 'ex ante', through a common questionnaire sent to each operator (with utilisation of the same units), or 'ex post ' by homogenising raw data provided by the professional operators.

Specific problems mentioned during the project work are, for example, the difference between a physical and a commercial ITU, because the scaling factor between them has changed over the past years. Another example is the change of units in general. Former statistics were based on the wagon / shipment unit, statistics of today are based on commercial units.

Use of advanced information technology (IT)

The main changes expected in the next five years concerning data collection methods and sources are linked to new technologies, allowing real-time collection of data. It concerns mainly data relating to transport chain structure, and to inter-modal transport performances. For other data, new technologies will allow new data collection methods. However, traditional methods, like analysis of statistical reports, of publications, use of internet or other relevant sources, surveys, interviews, traffic counts, etc., will continue to be essential.

Any data collection method will have to take into account the necessity of certifying the confidentiality of data provided by private operators, and to convince them that they can get real benefits. In return, a key issue might be the organisation of the feedback of information.

However, it is important to first accept that such operations focus primarily on a different (though related) task, at least today. The data gathered, for example, by tracking and tracing are not published and do not appear in official statistics, so they might not be accepted as official results. Further, tracking operations are solely interested in reporting the location (and its comparison against a schedule) of a commodity flow at given or requested times to customers. Consequently if a commodity flow is related at some level to a mobile tracking device, all that is needed for tracking purposes is a unique identification mark for the particular commodity flow.

The use of Electronic Data Interchange (EDI) as a possible source of transport related data and information, suffers - apart from the same issues on confidentiality and field of operational use mentioned above – from the problem of lacking standardisation and harmonisation of the today's message structures. EDI technologies are assumed being used for data collection purposes in 2005 at the earliest.

4.3 Research and Development Needs

In addition to the recommendations for the realisation of an inter-modal freight transport data base, at least three fields for further research could be identified within the INFREDAT project. These are:

'Master plan' for data collection

The INFREDAT model is very dependent on the input data available. Each format of available data sources in combination with data gaps on other aspects and for other countries results in a specific specification of the model to be applied. This implies that data availability issues should be solved before a definitive model can be determined. It can be stated that more progress can be made in model development, when it becomes clear on which data the model should focus. A lot of work has been done the previous years in the fourth framework and now in this project on identifying data needs and data availability. The moment is now, where a master plan can be developed in which the future data situation is described together with a strategy to realise this plan. Having such a master plan, other projects can concentrate on the modelling that suits a realistic future data situation or at least a realistic set of options that can be considered.

Multi-route inter-modal assignment

The multi-route inter-modal assignment model proposed needs further research. Several companies are working on such a model on basis of private financing since it is a crucial

element to be able to come to inter-modal data. A lot of research on this type of models still has to be done, however. An important gap in this development is the lack of terminal flow data. Also in this project, this data gap has been pointed out. For model development, a data set for a limited area would mean a big step forward.

Further research on costs and benefits

It is worth emphasising that a reliable quantitative estimation of the monetary benefits (to different users) derived from the availability of more and better inter-modal data as envisaged by the INFREDAT scenarios was beyond the scope of INFREDAT. The foundation has been laid within the project providing a sound basis for the project purposes. Nevertheless, this subject undoubtedly deserves further research work.

5 Annex on existing data sources

Table 5-1: Inventory of existing sources for inter-modal flow data

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected									Data availability									Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
1	Combined transport operators *(CEMAT, CNC...)*	P	N	Data concern mainly the rail part of the trip	N	Y	N	N	N	N	N	Y	N	N	Unitised	TEU	Swap bodies, containers, accompanied transport	N	Y	Y	N	N	Operational documentation (consignment note), usual management of the fleet	Real time for punctual data, monthly to yearly for agregated data	1998	National rail network + rail network in the country of destination	Digitized*, paper		X	Y	-	Available data are mainly modal, but can be used to explain part of the trip chain by processing the raw data and assessing their links. Due to the confidentiality, a part of data will be only available through professional organisations and aggregated
2	Railway operators *(RENFE, SNCF…)*	P	N	Data concern only the rail part of the trip	N	Y	Y	y	N	y	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other shipments	*TEU *NST3	Swap bodies, containers, (accompanied transport)	N	Y	Y	N	N	Operational documentation (consignment note), usual management of the fleet	Real time for punctual data, monthly to yearly for agregated data	1998	National rail network	Digitized*, paper		X	Y	-	Available data are modal, but can be used to restore the real trip by processing the data and assessing the links between various data. In spite of confidentiality, a part is directly available, an other part is available through professional organisations. Number of unit of transport, tonnage

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected									Data availability								Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
3	Road operators	P	N	They know if the nodal point of loading or unloading is inter-modal (railway station, port (sea or inland waterway), airport) or not.	N	N	N	N	Y	N	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	All	Detail of all products	Swap bodies, containers, trailers	N	Y	Y	N	N	Statistical data are generally not proposed by the road operators. However useful raw data are mentionned in consignment note.	Real time	1998	Countries where the operator is working	Paper and sometimes digitized*	X		Y	-	The main problem is the high dispersion of sources due to the structure of this profession. For the biggest operators, it is possible to obtain statistics (number of unit of transport, tonnage...), but for the others, it will be raw data. It is possible to get datilled data on a specific shipment.
4	Inland waterway operators	P	N	Data concern only the waterway part of the trip	N	N	N	Y	N	N	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other shipments	*TEU *NST3	Swap bodies, containers, trailers	N	Y	Y	N	N	Based on operational documents	Real time for punctual data, monthly to yearly for agregated data	1998	Linked to the waterway network	Paper and generally digitized		X	Y	-	Inter-modal transport using waterways is developping. Number of unit and tonnage
5	Inland waterway port authorities	P	Y	Mainly modal, but some operators try to link with terrestrial transport.	N	N	y	Y	N	y	N	Y	Y	Y	*Unitised *Other shipments	*TEU *NST3	Containers, trailers, trucks	N	Y if import	Y if export	N	N	The data concerning the maritime transport is based on documentation (bill of lading and manifests). Data concerning the terrestrial transport is collected from railway companies for rail (not always very detailed) and estimated for road transport.	Monthly to yearly for agregated data	1998	Local	Paper and digitized	X		Partialy	Free	A part of it (aggregated data) is available through public documentation of each port (statistics, yearly report…): Traffic of the month, by commodity group, by flag of the ship, by oversea country of origin or destination. Inter-modal estimation are made by the ports, but they are not publicised in general.

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected										Data availability									Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
6	Maritime companies	P	N	Generally, the maritime company cannot provide inter-modal information.	N	N	N	N	N	Y	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other shipments	*TEU *NST3	Containers, trailers, trucks	N	Y	Y	N	N	Based on operational documents (transport contracts, bill of lading, manifests…)	Real time	1998	Regions of the world served by the company	Digitized*, paper	X		Y	-	
7	" " If carrier haulage	P	Y	Some companies organise a door-to-door transport (carrier haulage). In that case, they can provide inter-modal information	Y	N	y	y	y	Y	N	Y	Y	Y	All	Detail of all products	Containers, trailers, trucks	Y	Y	Y	Y	Y								Y	-	Interesting for the companies which organise the door-to-door transport. Agregated data can be obtained by specific surveys
8	Air carriers	P	N	Their information is mainly modal	N	N	N	N	N	N	Y	Y	Y	Y	*Unitised *Other shipments	*TEU *NST3	Air containers	N	Y	Y	N	N	Based on operational documents	Monthly to yearly for agregated data		Not relevant	Digitized		X	Y	-	
9	Maritime port authorities	P	Y	Ports are inter-modal platforms. They collect data concerning maritime flows and terrestrial flows, but there is generally no connection between these two types of data	N	N	y	y	y	Y	N	Y	Y	Y	*Unitised *Other shipments	*TEU *NST3	Containers, trailers, trucks	N	Y if import	Y if export	N	N	Data concerning maritime transport is based on commercial documentation (bill of lading and manifests). Data concerning the terrestrial transport is collected from railway companies for rail (not always very detailed) and is estimated for road transport	Daily	1998	Regions of the world linked by maritime services, terrestrial hinterland of the port	Digitized*, paper		X	Partially		Aggregated data is available through public documentation of each port (statistics, yearly report…). Inter-modal data estimates are made by some ports, but they are not published in general.

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected									Data availability									Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
10	Airport authorities	P	N	The airports are inter-modal platforms. They collect data concerning the air flows. Specific surveys are performed for terrestrial flows but are not connected to air flows.	N	N	N	N	y	N	Y	Y	N	N	Unitised	NST3	Air containers	N	Y	Y	N	N	Based on operational documents	Monthly to yearly for agregated data	1998	Not relevant	Digitized		X	Partially	Free	A part of aggregated data is available through public documentation of each port (statistics, yearly report…). Traffic of the month, by commodity group, by flag of the plane, by oversea country of origin or destination. Inter-modal estimation are made by the ports, but they are not published in general
11	Shippers *(Indesit, VW)*	P	Y	If a shipper manages the transport, he has all the data concerning the chain of transport.	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	All	Detail of all products	All	Y	Y	Y	Y	Y	Based on operational documents (transport contracts, consignment note…)	Real time		Not relevant	Paper and generally digitized*	X		Y	-	The main obstacle to get inter-modal data is the confidentiality. Data can be obtained at an agregated level directly from the shippers. This level has to be discussed with each shipper
12		P	N	Otherwise, the subcontracting forwarders have these data	N	N	N	N	N	N	N						All	Y	N	N	Y	Y										
13	Forwarders *(Harms)*	P	Y	If the forwarder manages the transport, he has all the data concerning the chain of transport. More often, he manages only a part of the chain of transport	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	All	Detail of all products	All	Y	Y	Y	Y	Y	Based on operational documents (contract with the shipper, consignment note, bill of lading)	Real time		Not relevant	Paper and generally digitized*	X		Y		The main obstacle is the confidentiality. Data can be obtain at an agregated level directly from the forwarder. This level has to be discussed with each forwarder
14	Logistic operators	P	Y	Manages part of (or the whole) transport chain	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	All	Detail of all product	-	Y	Y	Y	Y	Y	Operational documents	Real time		Not relevant	Digitized	X		Y		

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3): Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Characteristics of data collected: Weight (tonnes)	Value	Commodity group	Aggregation level of data collected: Nature of shipment	Aggregation level of data collected: Indicator	Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Data availability: Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	Comments
					1	2	3	4	5	6	7																					
15	Rail operators associations *(UIRR, ICF, UIC)*	S	N	Data concern only the rail part of the trip. - UIC produces the rail unitised traffic by number of unit, by tonnes and by tkm, by operator, large containers in tonnes and number imported, exported or in transit by railway company according with the nature of border point for rail-road traffic and for sea-rail traffic; - ICF: unitised traffic in TEU and TEUkm by railway companies of O/D, and unitised transit traffic; - UIRR: international unitised traffic by O/D in tonnes and Tkm.	N	N	Y	N	N	N	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other shipments	*TEU *NST3	Swap bodies, containers, trailers, accompanied transport	N	Y	Y	N	N	Statistics are received from their members (voluntary)	Monthly to yearly	1998	Field covered by their members	Paper and generally digitized		X	Partially	Free	Data can be made available with the agreement of the members. A part of it (aggregated data) is available through public documentation of the associations
16	Ports associations *(i.e. ESPO)*	S	N	Their data is agregated in order to keep the confidentiality	N	N	Y	Y	N	Y	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other shipments	*TEU *NST3	Containers, trailers, trucks	N	Y	Y	N	N	Statistics are received from ports (voluntary collection)	Yearly	1998	Not relevant	Paper and generally digitized		X	No	Free	
17	Shipowners associations *(i.e. ECSA)*	S	?	Their role is mainly lobbying. They generally have few statistical data	N	N	Y	y	N	Y	N	-	-	-		-	-	N	Y	Y	N	N	Collection of aggregated data from their members (voluntary collection)	Yearly	1998	Not relevant	Paper and generally digitized		?	Y	-	

	Characteristics of data / Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected									Data availability								Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
18	Forwarders and shippers associations *(FIATA, FFE)*	S	?	Currently the collection of inter-modal data is not a core activity for these organisations. However some of them declare to have inter-modal data	N	y	y	y	y	y	y	?	?	?	All	NST 3 (?)	All	?	?	?	?	?	Collection of raw data from their members (voluntary collection)	Monthly to yearly		Not relevant	Paper and generally digitized		?	Partially		If available, data can be provided with the agreement of the members.
19	Authorities in charge of inland waterway *(VNF)*	S	N	They collect and agregate the data concerning inland waterway transport. Very few data are available concerning inter-modal transport. Y	N	N	N	Y	N	N	N	Y	Unit.: N Other: Y	Unit.: N Other: Y	*Unitised *Other sh.	*TEU *NST3	Swap bodies, containers, trailers	N	Y	Y	N	N	Collection of raw data from transport operators and inland ports authorities (voluntary collection)	Monthly to yearly	1998	Linked to the waterway network	Paper and generally digitized		X	Partially	Free	Aggregated data is available through public documentation of the organisation (e.i. VNF in France).
20	Ministries of transport and / or statistical offices	S	N	The inter-modal data provided by the ministries is limited to unitised transport by mode of transport.	Y	N	N	N	N	N	N	Y	N	N	*Unitised *Other sh.	*TEU *NST3	Swap bodies, containers, trailers	N	N	N	N	N	Collection of data from transport operators and professional associations by surveys and questionnaires. Exploitation of data provided by the customs	Monthly to yearly	1997	National	Paper and generally digitized		X	No	Low	The data provided by the Ministries and Statistical offices are the only official data
21	Customs	P	N	Data are related to trade, not to transport modes, except on voluntary basis (not comprehensive)	Y	N	N	N	N	N	N	Y	Y	Y	Not relevant	Two nomenclatures are used: NC (max 10 495 products) and SH (max 5113 product)	N	Y	Y	Y	Y	Y	Based on Customs entry (obligatory for the extra-EU trade). Data are based on dutiable goods: the packaging and mode of transport are optional for Customs.	Annual		World (outside Europe)	Digital data*		X	No	Low	Can be used for a macro-economic approach. Doesn't exist any more for intra-European market

	Characteristics of data Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected										Data availability								Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
22	Banks *(RABO bank…)*	S	N	Banks collect a lot of data of all kinds for their own use. It includes some data being potentially relevant for inter-modal transport: description of the trip, actors involved, contracts (trade and transport)… But this is not used for statistical purpose nor to follow the chain of transport	y	y	y	y	y	y	y	?	Y	?	Not relevant	?	?	Y	?	?	Y	N	Questionnaire sent to their clients	Not relevant		Variable	Paper and generally digitized*		X	Y	-	More and more data are requested by banks to fund any kinds of projects, including data on transport reponsibility and organisation.
23	Market research companies and Consultants	T	y	The role of these actors consists in preparing analysis (ad-hoc studies or regular information systems obtained through primary and secondary sources). They can provide a description of the main chains of transport (i.e.: MDSt produces data on unitised traffic in TEU for sea-rail transport, sea-road transport, sea-inland waterway transport by countries (NUTS 1); NEA produces inter-modal data on selected O/D by group of products).	y	y	y	y	y	y	y	Y	rarely	Y / N	All	Variable according to the study considered	All	N	Y	Y	N	N	All sources are used (primary, secondary, tertiary) and data collected are processed by the consultant according to in-house methodologies.	Not relevant		see annex 1	Digitized		X	No (7)	High	See detail of main 'ad-hoc' information systems in appendix 1.

	Characteristics of data Sources (5)	Nature of the source (1)	Inter-modal information (2)	General inter-modal information contents	Inter-modal variables (3)							Characteristics of data collected									Data availability								Comments
					Trade data (commodity flows by O/D)	Combined transport - other modes	Rail - other modes	Inland waterways - other modes	Road - other modes	Sea - other modes	Air - other modes	Weight (tonnes)	Value	Commodity group	Aggregation level of data collected		Type of transport unit (6)	First origin	Last origin	First destination	Final destination	Total chain length (4)	Collection method and origin of data	Updating frequency	Last year of availability of data	Geographical field	Format / support	Elementary shipment	Aggregated data	Confidentiality	Cost	
															Nature of shipment	Indicator															
					1	2	3	4	5	6	7																				
24	International Organisations *(Eurostat, ECMT, UNO…)*	S	N	Inter-modal data available are: -EUROSTAT: rail traffic of large containers, loaded or empty, in tonnes and number of containers, for national, international and transit traffic, by country (NUTS 1); -UNO: rail traffic of containers, swap bodies and road vehicles in tonnes and number of TEU, by country (NUTS 1), for national, international and transit traffic; -ECMT: international rail-sea traffic by country (NUTS 1) in number of wagon, and international road-sea traffic in number of road vehicle.	Y	N	N	N	N	N	N	Y	N	N	*Unitised *Other shipments	*TEU *NST3	Swap bodies, containers, trailers	N	N	N	N	N	Collection of data from national statistical offices or from Ministries of Transport (according to the case)	Monthly to yearly	###	Europe, world	Paper and generally digitized		X	Partially	Low	The inter-modal data provided by international organisations is limited to unitised transport by mode of transport.

Table 5-2: Inventory of existing sources for inter-modal equipment and infrastructure data

Sources	Nature of the source	Inter-modal variables						General inter-modal information contents	Specific data	Format / support	Comments
		Rail multimodal transfer nodes	*Airports*	*Sea ports*	*Inland ports*	*Logistic platforms (road-rail)*	*Environment variables **				
		8	9	10	11	12	13				
Research projects and information systems											
IQ / Inter-modal Quality *(Consortium, leader: INRETS)*	T	Y	N	Y	Y	Y	N	List of 400 terminals (40 are described in detail)	Localisation, equipment, access modes, transhipment facilities (capacity,…)	Digitised	Geographical field: Europe. Restricted access
IMPULSE *(Consortium, leader: Krupp Fördertechnik)*	T	Y	N	Y	Y	N	N	Description of existing inter-modal network and terminals	Road access (problems are specified), rail access (yes / no), surface (m2), expansion possibilities, stacking capacity, handling capacity, number of loading tracks, length of loading tracks, equipment (number, capacity in tonnes, movements per hour), modes of transport, traffic (number of containers, swap bodies, semi trailers, rolling road...).	Digitised	Restricted access
UTS / Union Territorial Strategy *(Consortium, leader: MCRIT)*	T	Y	Y	Y	Y	Y	N	Main transhipment points in Western Europe	Localisation, transfer times and waiting times at nodes	Digitised	Restricted access. Concerns western Europe.Designed for the modelling of travel times and costs on main European corridors.
PLANFREIGHT *(AND)*	T	Y	N	Y	Y	Y	N	Road, rail and inland waterway network data. 95% of the large European terminals are described in the data base		Digitised	Consists mainly in a model aiming at planning combined transport. Contains a data base on rail and road networks, as well as on terrestrial and maritime terminals. The data base is not operational. Geographical field: Europe
NEAC *(NEA)*	T	Y	N	Y	Y	Y	N	Rail, road and inland waterway networks.	Only some terminals are described	Digitized	

Sources	Nature of the source	Inter-modal variables						General inter-modal information contents	Specific data	Format / support	Comments
		Rail multimodal transfer nodes	*Airports*	*Sea ports*	*Inland ports*	*Logistic platforms (road-rail)*	*Environment variables **				
		8	9	10	11	12	13				
Research projects and information systems											
TEAM project *(PHARE programme)*	T	Y	N	N	Y	N	N	Rail-road terminas characteristics. Rail, road and waterway links	Capacities, saturation periods, physical bottlenecks	Paper	Not updated since 1993. Geographical field: trans-European axis in Central and Eastern Europe
Railway operators	P	Y	N	y	N	N	N	Inter-modal Platforms	Road access (specified when problems), rail access (yes / no), surface (m2), traffic (number of containers, swap bodies, semi trailers, rolling road).	Paper	
Rail networks operators	P	Y	N	y	N	N	N	Handling facilities	Handling capacity, number of loading tracks, length of loading tracks, equipment (number, capacity in tonnes, movements per hour)		
								Storage capacity	m² of storage, number and surface of warehouses, stacking capacity		
Logistic operators	P	N	N	N	N	Y	N	Inter-modal platforms characteristics	Handling capacity, storage surface, road and rail access	Paper	
Airport operators	P	N	Y	N	N	N	N	Airport characteristics	Apron capacity, terminal capacity, traffic (tonnes loaded / unloaded at the node)	Paper	
								Handling facilities	Number of cranes by category and capacity (in tonnes), of terminal tractors, fork lifts, straddlecarriers…		
								Inter-modality with other modes of transport	Access (yes or no) and specific difficulties (saturation…)		
								Freight storage capacity	m² of storage, number and surface of warehouses		
Airports operators associations *(ICAA, …)*	S	N	Y	N	N	N	N	Handling facilities	Number of cranes by category and capacity (in tonnes), of terminal tractors, fork lifts…		

Sources	Nature of the source	Inter-modal variables						General inter-modal information contents	Specific data	Format / support	Comments
		Rail multimodal transfer nodes	*Airports*	*Sea ports*	*Inland ports*	*Logistic platforms (road-rail)*	*Environment variables **				
		8	9	10	11	12	13				
Research projects and information systems											
				Y				Airport other characteristics	Apron capacity, terminal capacity, traffic (tonnes loaded / unloaded at the node)		
								Modes of transport	Access (yes or no) and specific difficulties (saturation…)		
								Freight zone capacity	m² of storage, number of warehouses (and m²)		
Air carrier associations (ICAO, IATA)	S	N	Y	N	N	N	N		Airport capacities		Restricted access
Ports authorities	P	N	N	Y	N	N	N	Port maritime access	Length of wharf, channel depth	Paper	
								Port terrestrial access	Rail, road, inland waterway: dockside railways, access tracks and roads, inland connections…		
								Handling facilities	Number of cranes by category and capacity (in tonnes), terminal tractors, fork lifts, straddlecarriers…		
								Connections with other modes	Dockside railways, access tracks and roads…		
								Storage capacity (with detail: dangerous goods, reefer containers…)	m² of storage, number of warehouses (and m²)		
Stevedores and handling operators	P	N	N	Y	N	N	N	Handling facilities	Number of cranes by category and capacity (in tonnes), mobile equipment… cost		
								Storage capacity	m² of storage, number of warehouses (and m²), cost		
Road-rail platforms operators	P	N	N	N	N	Y	N	Platforms	Access by mode (yes / no), area (m2), traffic (number of containers, swap bodies, semi trailers)	Paper	
								Handling facilities	Handling capacity,equipment (number, capacity in tonnes, movements per hour)		
								Storage capacity	m² of storage, number of warehouses (and m²), stacking capacity		

Sources	Nature of the source	Inter-modal variables						General inter-modal information contents	Specific data	Format / support	Comments
		Rail multimodal transfer nodes	*Airports*	*Sea ports*	*Inland ports*	*Logistic platforms (road-rail)*	*Environment variables **				
		8	9	10	11	12	13				
Research projects and information systems											
Inland ports authorities	P	N	N	N	Y	N	N	Waterway access	Lenght of quays, maximum depth	Paper	
								Terrestrial access	Rail, road: dockside railways, access tracks and roads		
								Handling facilities	Number of cranes by category and capacity (in tonnes), terminal mobile equipment…		
								Modes of transport	Access to other modes (yes or no) , specific difficulties (saturation…), connection with sea transport		
								Connection with other modes	Dockside railways, access tracks and roads…		
								Storage capacity	m² of storage, number of warehouses (and m²)		

Table 5-3: Inventory of inter-modal services data

SOURCES	Nature of the source	Inter-modal information	Data on Inter-modal Services											Contents / comments
			Schedules, frequencies	Punctuality, regularity	Transport capacity (according to O/D and schedule)	Total cost (for users)	Transhipment cost	Cost of main mode	Handling cost	Storage cost	Total transit time between first O and final D	Total transit time without waiting time (storage, customs)	Transit time of main mode	
			14	15	16	17	18	19	20	21	22	23	24	
Railway operators	P	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Data can be provided by Railway associations
Road operators	P	N	N	N	Y	N	Y	Y	Y	N	N	N	Y	Data can be provided by Professional and international associations
Air carriers	P	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Data can be provided by Professional and international associations
Maritime companies	P	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Data can be provided by Operator
Inland waterway operators	P	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Data can be provided by National organisations
Shippers	P	N	N	Y	N	Y	Y	N	Y	Y	Y	N	N	Data can be provided by
Forwarders	P	N	N	Y	N	Y	Y	Y	Y	Y	Y	N	N	Data can be provided by
Port authorities	P	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Data can be provided by
Inland port authorities	P	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Data can be provided by
Logistic platforms operators	P	N	N	N	N	N	Y	N	Y	Y	N	N	N	Data can be provided by
Stevedores	P	N	N	N	N	N	N	N	Y	N	N	N	N	Data can be provided by
Handling operators	P	N	N	N	N	N	N	N	Y	N	N	N	N	Data can be provided by
Warehouses operators	P	N	N	N	N	N	N	N	N	Y	N	N	N	Data can be provided by
IQ project	T	N	Y	N	Y	N	N	N	N	N	N	Y	Y	Data base on transport services (sea, containerised, rail-road and combined transport). 20 000 services are inventoried. Geographical field: Europe, including Switzerland

SOURCES	Nature of the source	Inter-modal information	Data on Inter-modal Services											Contents / comments
			Schedules, frequencies	Punctuality, regularity	Transport capacity (according to O/D and schedule)	Total cost (for users)	Transhipment cost	Cost of main mode	Handling cost	Storage cost	Total transit time between first O and final D	Total transit time without waiting time (storage, customs)	Transit time of main mode	
			14	15	16	17	18	19	20	21	22	23	24	
Planfreight (and Combiplanner)	T	N	Y	N	N	N	N	N	N	N	N	Y	Y	Planfreight is the successor of Combiplanner. It contains only permanent variables (other variables which vary in time, as prices, schedules,... are not included). It covers all modes except air. Geographical field: Europe, with a focus on the Netherlands.
3SNET	T	N	Y	N	Y	N	N	N	N	N	N	N	Y	3SNET is a DG7 project which is desgined to assist in improving the efficiency of shortsea shipping in Europe. The data base is available at www.shortsea.net
Electronic Shipping Guide (ESG)	T	N	Y	N	Y	N	N	N	N	N	N	N	Y	The ESG is a data base of all deepsea container services to / from Europe. It is updated monthly and available commercially on diskette and at www.shipguide.com

Member list of the Advisory Committee

Organisation	Name
B-Cargo*)	Mr. Denyn
Bundesamt für Güterverkehr	Mr. Kreienhop
European Federation on Inland Ports	Mrs. De Schepper
European Inter-modal Association	Mr. Fiquet
European Sea-Port Organisation	Mrs. Le Garrec
Eurostat	Mrs. Weckström-Eno
Freight Forward Europe*)	Mr. Hansen
Kombiverkehr KG	Mr. Mertel
DAEI / SES	Mr. Houée
Studiengesellschaft für kombinierten Verkehr e.V.	Mr. Müller
Union International de Chemin de Fer / EDIFER	Mr. Dermience
UIRR	Mr. Burkhardt
University of Leeds	Prof. Pearman

*) Expressed interest, but did not participate in a workshop

Publications

D 1	Identification and categorisation of inter-modal transport flows – User request on inter-modal freight transport data	public
D 2	Review report on inter-modal freight transport data and methodologies	public
D 3	Inter-modal freight transport data model & data base structure	public
D 4	Data collection approach	public
D 5	Cost-benefit analysis	public
D 6	Final report on pilot test cases	public
D 7.1	INFREDAT – Project Flyer	public
D7.2	INFREDAT – Discussion Forum (part of web-page: www.infredat.ptv.de)	public
D7.3	INFREDAT – Handbook: Conclusions and recommendations for the implementation and realisation	public
	Final report for publication (this document)	public

Workshops

Advisory Committee workshops were held in Brussels on:

16. March 1999

29. October 1999

29. February 2000

A presentation of the INFREDAT project results and conclusions is foreseen at the CONCERTO workshop on intermodality in Brussels on 13./14. June 2000.

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LOGIQ - The Decision-Making Process in Intermodal Transport, IV Framework Programme Research Project, Commissioned by European Commission, DG VII

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Toubol, A., "Possibilities and Limitations of Combined Transport", ECMT Round Table 90, Paris, 1991

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Internet research: Web-sites of transport journals, e.g. Traffic World, Cargo World, Deutsche Verkehrs-Zeitung with use of archives and thematic links

Public Authorities, Transport Market Observations

Several Port Authorities, Transhipment Volume Statistics

Several operators of combined transport, Annual Reports