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FAST SCREENING METHOD FOR THE ASSESSMENT OF FREIGHT DEMAND AT THE INITIAL PLANNING STAGE OF A TRANSPORT AND LOGISTICS CENTER

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Abstract: *This paper presents an empirical approach that allows pre-feasibility assessment of logistics infrastructure for defined locational and fleet constraints. It aims at developing a fast screening method for the assessment of demand of a public Transport and Logistics Center, which is important for properly selecting the Center's size and minimising the risk of over or under-estimation of capacity needs. The results are useful for policy makers to facilitate the early planning and commercialisation phases of a TLC project. The method develops the appropriate cost functions in order to compare two logistics strategies: one that involves the use of TLC to achieve economies of scale, and another one that assumes direct deliveries from origin to destination to save time and handling costs. The method has been applied as a pilot study in a case of a regional Center in Greece, advocating its applicability and reusability.*

Key words: *Transport and logistics center; logistics infrastructure; logistics cost; freight attraction; consolidation center*

1 INTRODUCTION

Public Transport and Logistics Centers (TLC) are essential components of logistics infrastructure. They consist of specialized zones offering land, transport infrastructure, common facilities and equipment that allow the spatial concentration of transport and logistics companies. The term "public" is used, primarily in Europe, to describe that the Center is accessible to multiple users, in contrast with logistics centers which are exclusively owned and used by a single firm *[1]*. The firms located in a public TLC can develop their own premises and independent activities, create synergies between them and also take advantage of the common facilities and services. Therefore, a TLC represents a nodal point within the supply chain networks which offers a variety of logistics services such as consolidation of goods, warehousing, storage, handling operations, coordination of shipments and flow management, services to transport means, transport units and human resources, banking and other administrative services for freight.

In Europe, the creation of public Transport and Logistics Centers generally results from “top-down” initiatives. These are most usually taken by local authorities or other public interest organisations, with the aim to offer favourable conditions for the development of local logistics business. In some cases, new public TLCs are integrated in larger regional planning policies. They are often financed by private investments or through public-private partnerships.

Typical processes leading to the implementation of public TLCs (planning, design, etc) usually follow practices which are based on real-estate business principles rather than on transport infrastructure development methods. These processes start from the supply side, exploring land availability in possible areas of interest. Through direct negotiation (with potential clients) or via open calls launched by the project promoters, a number of candidate transport and logistics firms express their interest for using the Center, stating also their needs for land, logistics facilities and services. Based on feedback from this process, the project promoters define the size and elaborate the preliminary design of the TLC.

It is clear that such development process is based on business heuristics to assess the market’s acceptance of the new project. Interested companies make decisions about using the new TLC based on empirical market evidence and on feedback from the negotiation process. The assessment of their expected benefits -from reduction of operating costs and from synergies with other TLC residents- is usually “hidden” under the relocation decisions. The project promoters oddly do little to support these decisions on the assumption that as soon as a client has expressed interest for the Center the math has already been done. Likewise, the project promoters tend to overlook the need for assessing the freight attraction of a TLC, insofar the process of expression of interest has yielded sufficient demand to render the project commercially viable. From past experience we know that such processes usually lead to preliminary TLC designs confined to real estate market projections, which ignore freight traffic dynamics and possible network effects. Moreover, overestimated or underestimated real estate demand has resulted in erroneous dimensioning with evident consequences on the commercial success of the project.

This paper follows a complementary approach to the development process outlined above. The main objective is to estimate the freight demand that will be drawn to a TLC regardless of the interest that might be expressed by commercial firms. This should be done at the earliest possible stage of the feasibility analysis process, with the aim to reduce investment risk and environmental hazards and provide common reference for the negotiations between the interested parties. To facilitate this process we propose a fast screening method that allows for the assessment of a TLC's freight demand through evaluation of two network optimization choices: one that involves direct deliveries and another that uses a hub and spoke network.

The suggested method is applied to the new public TLC in Argolida-Greece as a pilot study. Analysis of the results provides insight of the anticipated demand and also useful conclusions about the applicability and reusability of the method.

2 LITERATURE REVIEW

The existing literature shows limited work on specialised freight models for public Transport and Logistics Centers. Instead, the main research interest lies on transhipment problems since freight attraction of a TLC is linked to both cargo consolidation operations and transhipment decisions *[2]*.

Existing literature is abundant with business logistics and decision-making research which is a field where the suggested method envisages contributing. The literature offers a sizeable work for transhipment problems in firm or industrial inter-plant networks. The problems at the inter-firm level differ substantially from the problem considered in this paper as the corresponding networks are well defined, the number of network nodes (plants, premises) is small and the total freight volumes are known. Consequently, the methods addressing such problems are focused on minimising the total transport cost through optimisation of flows, using transhipment terminals when appropriate *[3]*.

Various authors have addressed freight distribution problems by following continuous approximation approaches *[4]*. The emphasis in their work is on approximating a near-optimal network geometry that can be described by few quantities such as the number of stops on each vehicle route and the number of transhipments. An extended analysis aiming to determine optimal routes (direct or via a consolidation terminal) is provided by Burns et al. *[5]*. The work considers many-origins-to-many-destinations with transhipment and is oriented towards solving optimisation problems at the scale of inter-plant networks, by considering trade-offs between transportation and production cost. The assumption is that inbound and outbound shipments at the consolidation centre are independent which offers the possibility to switch production between plants.

An interesting model dealing with a many-origins-to-many-destinations distribution problem with transhipment centres and local peddling is proposed by Daganzo *[6]*. The vehicle routes are analysed in more than two legs (origin-terminal and terminal-destination); there exists a local collection leg in which a number of stops are made, a local distribution section in which a number of stops are also made, and a line-haul part between the two local ends. This model defines optimal routes of vehicles by combining local delivery operations and long distance transport of goods. The routing strategies aim primarily at minimising the distance added to the direct distance from its origin to its destination.

Another method for comparing direct delivery to delivery via a hub for many-origins-to-few-destination networks is proposed by Hall *[7]*. The method suggests an optimisation procedure relating shipping cost to flow, using the concept of the "critical flow" as a way to determine the optimal routes for individual origin-destination pairs. A network decomposition method with sub-networks of one origin and N destinations simplifies the problem.

Daganzo *[8]* has presented a method dealing with the shipment composition enhancement at a consolidation center. This work examines the case of transportation between many origins and one destination at an inter-plant level. It determines which items from each origin should be combined together to form a shipment, the routing (direct or through the terminal) and the composition of these shipments from the terminal to the destination. It is assumed that inventory cost is very small and handling costs at the terminal are not considered.

As concerns logistics decisions, the literature review shows a wide range of key concepts underlying the modern business decision process. These concepts relate to management strategies and business models (e.g., JIT and e-commerce), global markets and sourcing, new information and communications technologies, a renewed focus on customer satisfaction (e.g., 24-hour service), new transport service options (e.g., overnight delivery), and increasing environmental awareness (e.g., recycling), etc. Although the logistics decision environment changes as new services, technologies and operations become available, basic decisions still have to be made: should a TLC be used?

Many authors have classified logistics activities and decisions into different functions, suggesting various categorizations (see for example, *[9]; [10]; [11]; [12]; [13]; [14]; [15]*). These works generally enumerate the logistic functions, and indicate that many of the decisions are interdependent and should be made concurrently. Models for solving related problems (facility location, vehicle routing and inventory management) are often presented in detail, but the higher level view detailing the precedence relations among all decisions is lacking.

It is one of the main objectives of this paper to provide an empirical approach that can yield some of the additional information required for these decisions. More specifically the aim is to contribute to the long-term strategic decisions involving physical facility sizing and location and to short-term tactical or operational decisions, such as demand forecasting and routing of vehicles.

3 DESCRIPTION OF THE METHOD

3.1. Basic assumptions

The proposed method is based on the tradition of organizing the various logistics activities with respect to transportation cost. The method is capable of receiving inputs concerning shipments' pick-up and delivery points, costs per unit of load, average vehicles occupancy rates and it can generate outputs permitting the assessment of the attractiveness of a TLC for transport and logistics companies. It is easy to use by project promoters and/or property developers and has the potential to be a decision support tool for the selection among different locations for developing such a facility.

The method deals primarily with Transport and Logistics Centers served by road. It starts with the comparative assessment of two alternative transport-logistics strategies: one involving the use of the TLC to achieve higher consolidation rates and economies of scale, and another one that involves direct deliveries from origin to destination to save time and handling fees. Potential users will take advantage of the first option provided they can reduce their logistics cost through consolidation of goods at the TLC *[16]*. Possible disadvantages of this option include route deviation, additional distance travelled to destination, handling costs at the Center, and increased rates of lost or damaged goods *[17]*.

The TLC is assumed to operate as a consolidation hub creating alternative hub and spoke networks from origins to destinations. A TLC is not expected to generate new traffic but to attract a share of existing freight volumes, assuming that inbound and outbound shipments are independent.

3.2. Structure and consecutive steps

The proposed method follows a framework, comprising three steps:

1. Single origin-destination pair:
   i. Unit Costs: The transportation cost per unit of load is estimated assuming: (a) routing through the Center and (b) a direct haulage for each origin-destination pair
   ii. Cost Differences: calculation of cost differences, corresponding to the two routing options, for each OD pair.
   iii. Attracted Demand (V): when differences are negative no flows are expected to the Center. When positive, the attracted flows are proportional to money savings generated by the Center, weighted by average occupancy rate of available vehicles at each origin-destination pair[1].
2. Multiple origin-destination pairs: The previous step is repeated for every combination of origin-destination O_iD_j, to assess the attracted demand V_{ij}.
3. Assessment of demand: Aggregation of the V_{ij} quantities to compute the Center's total attracted freight flows.

In a given decision situation, alternative TLCs can be evaluated following the above steps of the method and by receiving project-specific values corresponding to the parameters employed by the method.

Step 1. Single origin-destination pair

Assuming that on the same origin-destination pair similar commodities are moved and that shipments show certain regularity (third party transport and logistics companies usually combine regular and ad-hoc demand to regular transport services), the transportation cost per unit-of-volume per kilometer is assessed as shown in equation 1:

$$P_d = C_d / d_0 \qquad (1)$$

where C_d = cost per unit-of-volume of shipment, and d_0 = distance between origin and destination.

The operating vehicles can enter the TLC partially loaded and leave fully loaded, partially loaded and leave empty or enter empty and leave partially or fully loaded. In any case, if shipments are to be routed through a Transport and Logistics Center it is because they will be consolidated with other loads.

A trip with a stopover in the TLC is divided into two legs, i.e. the leg from origin to the Center (d_1), and the leg from the Center to destination (d_2). In the second leg loads are consolidated with other loads and the respective vehicles can be assumed fully loaded[2]. This assumption is made in order to have an upper limit estimate of demand for properly selecting the TLC size. From an investor point of view, a more conservative assumption (leading to a smaller project) would entail scalability risks as land acquisition after the completion of the project is more expensive and difficult to achieve.

In a similar vein, the total transportation cost per unit-of-volume comprises two individual costs associated with the trip legs from origin to the Center (c_1) and from the Center to destination (c_2). Different cost rates per unit-of-volume may apply on these legs, with the cost on the second leg being minimised (trucks are assumed to travel on full or almost full capacity on this leg). Finally, the use of the Center generates an additional cost C_T which corresponds to the handling fees, i.e. loading, unloading, and eventual short storage, to form the consolidated loads. The transportation cost (C_t) per unit-of-volume is given in Equation 2 below:

$$C_t = P_{d_1} d_1 + P_{\min} d_2 + C_T \quad (2)$$

where P_{d_1}= cost per unit-of-volume per kilometer for the first leg, P_{min} = cost per unit-of volume per kilometer for the consolidated shipment, d_1= the distance between origin and the Center, d_2= the distance between the Center and the destination; and C_T = handling cost per unit-of-volume.

The transportation cost per unit-of-volume per kilometer in the case of routing through the Center is given by equation 3:

$$P_t = \frac{C_t}{d_1 + d_2} \quad (3)$$

For each considered origin-destination pair, the percentage of the freight flows drawn to the Center is a function of the difference of average unit costs corresponding to the two options (direct delivery and delivery via the Center): the greatest the difference (C_d – C_t), the higher the share of freight traffic to be attracted to the TLC. This function, however, is not "linear" across the whole range of ($C_{di} - C_{ti}$) values, and in particular around the low zone. The reason is that businesses tend to ignore small savings which are usually associated with fully (or almost fully) loaded direct deliveries. To account for this behavior we have introduced a calibrating factor f(λ) -in the calculations of attracted demand (see Equation 4)- allowing for a diminishing effect as vehicle occupancy rates soar.

Following that, the share of freight traffic to be attracted to the Transport and Logistics Center is (Equation 4):

$$a = \max\left[0,\ \frac{C_d - C_t}{C_d} f(\lambda)\right] \quad (4)$$

where λ = average occupancy rate of vehicles, and f a strictly decreasing function with extreme values $f(0) = 1$ and $f(1) = 0$.

In a simplified form, f(λ) can be $f(\lambda)=(1-\lambda)^p$ for some positive value of p. Alternatively, it may assume any convex combination of the p-family functions. Both f and p depend on decision heuristics of the Center's users and can be calibrated using data from the research literature or from similar TLC examples.

The freight demand V_t, associated with each origin-destination pair that is to be attracted in the TLC is given by Equation 5 below:

$$V_t = a \times V \quad (5)$$

where V is the aggregate freight flows on each origin-destination pair.

Step 2. Multiple origin-destination pairs

Step 2 applies Equation 5 as many times as the number of the origin-destination pairs O_iD_j. The results consist of nxn values of V_{ij}. Detailed application of the process is shown in the illustrative example of section 4.

Step 3. Assessment of the freight transport demand expected at a new Transport and Logistics Center

The total freight demand V_T of a TLC results by summing the V_{ij} values computed in step 2 as shown below (Equation 6):

$$V_T = \sum_{i=1}^{n}\sum_{j=1}^{n} V_{ij} \tag{6}$$

3.3. Data requirements

To apply the proposed method, the following data needs to be compiled:

- Travel Analysis Zones (TAZ), corresponding to the different zones of origin and destination;
- Distances d_{ij} between zone centroids;
- Freight flows between zones in tones or TEUs;
- C_d = average cost per unit-of-volume of shipment;
- P_{min} = average cost rate per unit-of-volume for consolidated shipment per kilometer;
- C_T = Average handling cost per unit-of-volume;
- λ = average occupancy rate of trucks.

It is recommended that the zoning system corresponds to one of the levels of administrative division of national territories (e.g. districts, administrative regions etc). This would provide significant advantages in terms of data availability, since official statistics are usually offered at these levels of spatial detail. Data might include:

- centroid distances between administrative zones, which are largely available from official sources.
- aggregate freight data between zones, usually available by official statistical editions.

All the other input required by the method can easily be obtained from a questionnaire survey on a sample of transport and logistics companies. More specifically:

a) The value C_d for each origin-destination pair can be defined as the weighted average of the (n) surveyed C_{d_i} values (Equation 7). These values are weighted by the amount of traffic moved at each rate to account for possible rate diversity:

$$C_d = \frac{1}{n}\sum_{i=1}^{n} C_{d_i} \tag{7}$$

b) It has been argued that the average cost per unit-of-volume per kilometer is minimized for consolidated shipments. Therefore, the value P_{min} for any origin-destination pair O_iD_j is estimated as follows (Equation 8):

$$(P_{\min})_{ij} = \frac{1}{d_{ij}} \min\left[(C_d)_{ij} \right] \tag{8}$$

Another way to define P_{min} is to divide the weighted value of C_d with the relevant distance.

c) For each origin-destination pair, the values of C_T and λ may also result from averaging the surveyed values of C_{T_i} and λ_i as shown in Equations 9 and 10:

$$C_T = \frac{1}{n}\sum_{i=1}^{n} C_{T_i} \tag{9}$$

and

$$\lambda = \frac{1}{n}\sum_{i=1}^{n} \lambda_i \tag{10}$$

Summarising, the suggested method shows some interesting features in terms of data requirements. The necessary input can be obtained easily from national statistics agencies and low-cost market surveys, using short questionnaires.

4. PILOT APPLICATION OF THE METHOD IN THE CASE OF A TLC IN ARGOLIDA, GREECE

The developed method has been applied for assessing the potential freight demand for a new public Transport and Logistics Center in the Argolida district and the results are reported.

The study area was divided in 53 TAZs, corresponding to the 53 administrative districts of the Greek territory. This has resulted in a 53×53 origin-destination matrix. Thorough examination of the study area shows that there is a large number of origin-destination pairs that is unlikely to contribute to the TLC's traffic, because they are far from the Center and their traditional trade paths do not intersect with the Center's catchment area. Excluding these zones from consideration left 25 origin-destination pairs with traffic that could be potentially attracted by the new Center. In these zones, a market survey was launched to collect the following data:

- Values of $C_{d\,i}$
- Values of $C_{T\,i}$
- Values of λ_i

Distances between zones were compiled from official sources of the Greek Ministry of Transport *[18]*. The analytical input data is shown in Table 1 below.

Tab. 1 *Input Data*

Origin	Destination	V	d_0	d_1	d_2	P_{min}	C_d	λ
AITOLO	LACON	1.638,6	318,0	283,0	133,0	0,1	56,6	0,6
ARGOL	ACHAI	691,5	201,0	0,0	201,0	0,1	17,3	0,7
ARGOL	ATTICA	2.639,0	165,0	0,0	165,0	0,1	13,4	0,7
ARGOL	CORINT	1.318,8	63,0	0,0	63,0	0,1	5,7	0,6
ARGOL	LARISS	188,6	452,0	0,0	452,0	0,1	57,0	0,7
ARGOL	THESAL	565,8	622,0	0,0	622,0	0,1	59,1	0,6
ARGOL	VIOTIA	880,1	281,0	0,0	281,0	0,1	23,3	0,7
ATTICA	LACON	2.384,8	254,0	144,0	133,0	0,1	21,1	0,7
ATTICA	ARCAD	4.600,2	195,0	144,0	73,0	0,1	15,8	0,5
EVIA	LACON	401,8	343,0	254,0	133,0	0,1	48,4	0,6
EVIA	ARCAD	1.249,1	284,0	254,0	73,0	0,1	38,1	0,5
FOKIDA	LACON	68,3	440,0	351,0	133,0	0,1	73,0	0,7
FTHIOT	ARCAD	31,4	349,0	309,0	73,0	0,1	60,0	0,5
IOANNI	ARCAD	269,2	423,0	448,0	73,0	0,1	61,8	0,7
KARDIT	LACON	146,2	560,0	450,0	133,0	0,1	94,6	0,7
CORINT	LACON	1.741,1	170,0	63,0	133,0	0,1	20,9	0,6
CORINT	MESINI	1.307,9	200,0	63,0	163,0	0,1	23,4	0,6
CORINT	ARCAD	982,6	110,0	63,0	73,0	0,1	10,8	0,6
LARISS	LACON	191,3	559,0	452,0	133,0	0,1	97,3	0,7
LARISS	ARCAD	86,1	499,0	452,0	73,0	0,1	79,3	0,5
MAGNE	ARCAD	449,6	464,0	423,0	73,0	0,1	74,7	0,7
THESAL	LACON	367,6	711,0	622,0	133,0	0,1	69,0	0,5
THESAL	ARCAD	239,2	651,0	622,0	73,0	0,1	61,8	0,6
VIOTIA	LACON	174,9	370,0	281,0	133,0	0,1	32,9	0,7

VIOTIA	ARCAD	221,4	311,0	281,0	73,0	0,1	25,8	0,7
Total		**22.835,6**						

In the above table:

- Columns 1 and 2 present the origin-destination pairs which are possible sources of demand for the Center.
- Column 3 presents the daily freight flows per origin-destination pair, in m^3.
- Columns 4, 5 and 6 present the distances d_0, d_1 and d_2 for each origin-destination pair.
- Column 7 presents the value P_{min} for each origin-destination pair, as resulted from the application of equation 8.
- Column 8 and 9 present the values of C_d and λ respectively, for each origin-destination pair.

Using the data of Table 1, equation 7 has been invoked to compute the cost of direct routing C_d for each origin-destination pair. By applying equation 9 the cost of routing through the Center C_T was estimated. Finally, equation 10 returned the value of the average occupancy rate λ for each origin-destination pair. These results were then passed to inform equations 1 to 6 which yielded the results of Table 2.

Tab. 2 *Results*

Origin	Destination	P_d	C_t	α	V_t
AITOLO	LACON	0,2	63,7	0,0	0,0
ARGOL	ACHAI	0,1	14,8	0,1	56,2
ARGOL	ATTICA	0,1	12,3	0,0	117,8
ARGOL	CORINT	0,1	5,2	0,1	78,3
ARGOL	LARISS	0,1	36,9	0,2	34,0
ARGOL	THESAL	0,1	44,3	0,2	86,3
ARGOL	VIOTIA	0,1	20,4	0,1	57,4
ATTICA	LACON	0,1	22,9	0,0	0,0
ATTICA	ARCAD	0,1	17,4	0,0	0,0
EVIA	LACON	0,1	47,0	0,0	7,0
EVIA	ARCAD	0,1	39,6	0,0	0,0
FOKIDA	LACON	0,2	72,4	0,0	0,3
FTHIOT	ARCAD	0,2	59,9	0,0	0,1
IOANNI	ARCAD	0,2	73,8	0,0	0,0
KARDIT	LACON	0,2	89,2	0,0	4,9
CORINT	LACON	0,1	17,6	0,1	172,6
CORINT	MESINI	0,1	19,7	0,1	132,2
CORINT	ARCAD	0,1	12,9	0,0	0,0
LARISS	LACON	0,2	89,6	0,0	8,1
LARISS	ARCAD	0,2	79,6	0,0	0,0
MAGNE	ARCAD	0,2	75,0	0,0	0,0
THESAL	LACON	0,1	73,6	0,0	0,0
THESAL	ARCAD	0,1	68,8	0,0	0,0
VIOTIA	LACON	0,1	35,4	0,0	0,0
VIOTIA	ARCAD	0,1	28,3	0,0	0,0
Total					**755,2**

In the above table:

- Column 3 presents the values P_d per origin-destination pair as resulted from the application of equation 1.

- Column 4 shows the value C_t for each origin-destination pair, as resulted from the application of equation 2 for a fixed handling cost of C_T=0.75 EUR/unit-of-volume.
- Column 5 presents the value a for each origin-destination pair, as resulted from the application of equation 4, setting $f(\lambda) = \sqrt{1-\lambda}$, for p=½.
- Column 6 presents the value V_t for each origin-destination pair, as resulted from the application of equation 5.
- Last Row of Column 6 presents the total freight volume attracted to the TLC, computed from equation 6. It can be seen that the total expected demand for the new Center corresponds to a daily freight volume of 755,2m^3, which represents 3.3% of the total freight flows between the origin-destination pairs considered.

Since this analysis was carried out at the pre-feasibility stage fixed costs of establishing the TLC were not modelled - these costs play an important role in deciding the exact location of the facility at a later stage.

5. CONCLUSIONS

This paper aims in rationalising existing processes in the implementation of public TLCs. It adds to existing state of research by developing a freight forecasting method which can be readily applied to support TLC promoters during the stage of pre-feasibility analysis. Such practices are to a large extend based on empirical market evidence and real-estate business principles. In this framework, the proposed method presents the following advantages:

a. it considers a public Transport and Logistics Center as a transport infrastructure project rather than a real estate project;
b. it provides a more objective assessment of the potential freight demand of the Center;
c. it contributes to properly selecting the Center’s size and minimising the risk of over or under-estimation of the real capacity needs.

The proposed method can be a useful decision support tool for the responsible authorities, essentially at the initial planning stage of a Center. It can also help policy-makers to identify target markets by highlighting the origin-destination pairs which are more important for the new Center in terms of potential demand.

Moreover, the method requires easy-to-get input, which can be obtained from official statistics and by low-cost transport market surveys. It is considerably less time-consuming and costly, compared to other approaches employing behavioural-disaggregate methods. The method contributes in rationalising the commercialisation process of a TLC without losing track of the needs of the companies that will be located in the center.

The application of the method in the case of the new TLC in Argolida has showed 755,2m^3 of potential freight demand per day, corresponding to 3.3% of the total freight flows passing through the Center’s catchment area. This percentage is in alignment with figures observed in comparable TLCs in use today, where the demand varies between 2% and 4% of the total flows *[18]*. Even if these figures seem low, they represent significant volumes in absolute terms. For instance, in regions with high freight traffic (e.g. south-western Germany, northern Italy) they correspond to annual traffic of tens of million tonnes. In TLCs of local importance, such as that of Argolida, they are interpreted to traffic of more than one hundred trucks of different sizes per day.

ENDNOTES

1. As the method focuses on decisions taken by the transport companies, longer transit times and other factors that differ between direct delivery and TLC routings, such as rates of lost or damaged goods, are not considered in the cost function. The possible repercussions that these factors might have on downstream demand can be compensated by reduced prices, provided, of course, that the demand elasticity is such as to allow it.
2. As a rule, the use of the Center allows optimising the fleet productivity of the firms located in the facility. Each vehicle is assigned to the appropriate leg(s) of the company network in order to minimise the total vehicle-kilometers produced at that level. All journeys operated by a company are considered and not only those directly affected by the TLC.

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