

# **A STAKEHOLDER BASED EVALUATION FRAMEWORK FOR CITY DISTRIBUTION**

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## **ABSTRACT**

Urban areas face particular challenges for freight transport, both in terms of logistical performance and environmental impact. A range of regulatory, technological and logistical measures has been tested, most of them suffering from a lack of systematic evaluation and assessment of their short and long term effects, which impedes knowledge transfer and the adoption of best practice. As a consequence, large-scale or long-term adoptions often fail, although many initiatives seemed successful in pilots and demonstrations. There is a clear need for a comprehensive approach to evaluate urban freight solutions in order to assess their chance of success.

The evaluation framework was worked out within the Straightsol project (Strategies and measures for smarter urban freight solutions, EC FP7). The evaluation framework must allow a thorough evaluation of the seven demonstrations that will be executed during the Straightsol project, but should also be a framework for other evaluation situations within the context of city distribution and urban-interurban interaction. Many innovative city distribution concepts fail because not all stakeholders are taken into account (Macharis & Melo, 2010). That is why within Straightsol, actors and their objectives are the primary focus within the evaluation framework. The Multi-Actor Multi-criteria analysis (MAMCA) methodology developed by Macharis (Macharis, 2000, 2005 & 2007) ties with this aim and is complemented with other methods such as the Cost Benefit Analysis and Business modelling.

This paper fully describes the evaluation framework with its methodological and step-by-step approach. Also the combination of complementary methodologies is presented. The relevant stakeholders within urban and interurban freight transport context are shown together with their main criteria.

*Keywords: stakeholder, evaluation framework, freight transport, MAMCA*

## **INTRODUCTION**

Urban goods distribution plays an important role in the sustainable development of cities .It helps support urban lifestyles, serve and retain industrial and trading activities and contributes to the competitiveness of industry in the region concerned (Anderson et al, 2005). Logistics is required to replenish food stocks and other retail goods in shops, to deliver

supplies to offices and remove household waste from urban areas (DGMOVE, 2012). Urban freight transport however also generates many problems, such as congestion, pollution, traffic safety etc. In order to tackle these particular challenges in a city distribution context, technological and logistical measures including innovative concepts have been tested and new developments are on their way. Within STRAIGHTSOL the following measures are demonstrated:

- Night-time distribution in Utrecht (TNT Innight)
- New regulations on loading/unloading operations in Lisbon (EMEL)
- Rail tracking and warehouse management in Thessaloniki (K+N)
- Standardized information in last mile distribution in Oslo (GS1)
- Urban consolidation centre in Barcelona (DHL)
- A mobile depot for city deliveries in Brussels (TNT Express)
- New remote “bring-site” monitoring systems in United Kingdom (Oxfam)

More information about the demonstrations is available on the STRAIGHTSOL website<sup>1</sup>. Many cities have tried to find and implement their own solutions, aiming to support both their growing activities and their quality of life. However, although many initiatives seemed successful in pilots and demonstrations, unexpected side-effects may occur with the large scale or long term adoptions, as illustrated in the unsuccessful implementation of urban freight consolidation centres in many cities (Marcucci & Danielis, 2008, Browne et al, 2005). These pilots and test cases show that many of these freight platforms are granted only a short lifespan because not all the stakeholders, with their own and often conflicting objectives, are involved early on the decision process. Besides, there is a lack of systematic assessment of the effects of different measures, which is why there is a clear need for a comprehensive approach to evaluate urban freight measures within the urban and inter-urban context and across regions in the European Union. Consequently, a new assessment framework has been developed for the evaluation of measures applied to urban-interurban transport interfaces within the STRAIGHTSOL project (Strategies and measures for smarter urban freight solutions, EC FP7). To ensure the success of the adopted measures, this new framework includes multiple methodologies. Among them, a Multi-Actor Multi-Criteria Analysis (MAMCA) (Macharis, 2007) stresses the involvement of various stakeholders in the decision process as well as on the impact of measures taken both on society and in the private sector. This paper describes the stakeholder-based approach of this overall framework with the elaboration of a City Distribution dedicated Multi-Actor Multi-Criteria Analysis (CD-MAMCA). First, because of the important role they play, the stakeholders within a distribution context are discussed using a literature study and are validated by an iteration process with the project partners. The unambiguous context-based key criteria for each stakeholder are clearly identified. Secondly, the City Distribution dedicated Multi-Actor Multi-Criteria Analysis (CD-MAMCA) framework is presented with its complementary methodologies, i.e. Social Cost Benefit Analysis and Business Modelling. Finally, a more step-by-step approach is explained through the STRAIGHTSOL framework description.

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<sup>1</sup> [www.strightsol.eu](http://www.strightsol.eu)

## **STAKEHOLDERS AND OBJECTIVES**

Among the local specificities, the different stakeholders' unique perspectives are central in logistics. Indeed, urban freight policies may succeed only if they are supported by the freight carriers and their organizations, the local business groups and the local residents (Dablanc, 2011). The following section identifies all relevant stakeholders together with their important objectives and how they are achieved.

### **Stakeholders: general definition**

Many authors stress that stakeholder involvement is an essential requirement for the successful outcome of any project. Indeed, each actor has a very specific role and specific responsibilities through a decision process. The concept of stakeholders was first introduced in the research field of strategic management (Williamson, 1991). These stakeholders needed to be taken into account because firms were focusing more and more on corporate social responsibility (Donaldson and Preston, 1995; Buysse and Verbeke, 2003). There is no however single, generally accepted definition of the term, as is discussed in (Macharis et al, 2013). Freeman (1984) defines a stakeholder as an individual or a group of individuals who can influence the objectives of an organization or can be influenced themselves by these objectives. This definition is very organizational and business-oriented. Another definition is suggested by (Banville et al, 1998) where a stakeholder is someone interested in a problem in any one of the following three ways: a) by mainly affecting it, b) by mainly being affected by it and c) by both affecting it and being affected by it. In the definition by (Macharis et al., 2013), stakeholders are any group of people, organized or not, who share a common interest or stake in a particular issue or system. A stakeholder should be rather defined based on his/her stake in the issue, as this determines whether he/she can affect or will be affected by the ultimate outcome. Another useful distinction can be made according to the relative influence (the power certain stakeholders have over the success of a project) and importance of the stakeholders (those whose needs and interests are the priorities of aid) (Grimble and Wellard, 1997). At the strategic level, it is not manageable to directly involve individuals from the general public. Stakeholders should then represent organized or non-organized groups.

### **Stakeholders within the city distribution context**

Regardless of the definition used, urban freight transport initiatives and policies clearly involve multiple stakeholders who need to be explicitly considered in the decision making process and range from professional stakeholders such as carriers and suppliers to citizens living and working in this urban environment. The identification of the relevant stakeholders for urban freight transport is based both on a literature study and on the input of the project's seven demonstrations. Within the literature on urban freight transport we encounter more or less the same categories over and over. For Witlox (2006), there are three groups of stakeholders: trade and industry, society, and public policy makers. Trade and industry include suppliers, carriers, receivers, wholesalers and distribution companies. Society consists of inhabitants, employees, commuters, consumers and tourists. Public policy

makers are local, regional and national governments. Taylor (2005) identified four key stakeholders for the specific purpose of freight transport: shippers, residents, freight carriers, planners and regulators. Each stakeholder has his/her own objectives and his/her own role. Quak (2008) identified four key stakeholders for urban freight transport in the railway sector: local authorities, carriers, shippers and receivers, and residents. More recently, the framework of Behrends (2011) focused on the purpose of sustainable development and divided stakeholders into three groups: shippers and receivers, authorities, and transport operators.

## **STRAIGHTSOL validation**

In order to complement this theoretical knowledge with practical input, the participating scientific partners within STRAIGHTSOL were asked to collect specific information about the demonstration for which they are responsible. They were told to describe the context of the demonstration, the previous way of working, the possible alternatives for this way of working, which of these alternatives was going to be tested in the demonstration and what the expected outcomes were. The respondents were also asked to make a list of the various people, groups of people or companies affected by the demonstration. The goal here was not to use generic terms like “customers” or “receivers”, but to be very specific. For each stakeholder group, they were also asked to list their objectives based on conversations and interviews with representatives of these stakeholders or stakeholder groups. In order to arrive at a generic framework of stakeholders, the literature was crossed with the input from each of the demonstrations. First of all, based on the literature and the expert knowledge within the STRAIGHTSOL consortium, a first provisional list of stakeholder groups was drawn. Each of the actors involved in a STRAIGHTSOL demonstration was then assigned to one of these categories together with their objectives. The objectives of the actors in one stakeholder group had to match, otherwise, the actor was placed in another stakeholder group or the list of stakeholder groups was adjusted. Drawing up a final list of urban freight stakeholders was a long process including multiple reviews and adaptations. The academic partners of the STRAIGHTSOL project confronted the stakeholders of the demonstration they were involved in with the provisional list of stakeholders and criteria. Their feedback confirmed the relevance of the choices made, but also led to some adaptations. Furthermore, this adapted list was also submitted to the European Reference Group of the project. The latter’s comments and remarks resulted in further adaptations. To sum up, based on a literature review on the topic and with the backing of all the partners within the project, five relevant stakeholders in the urban and urban-interurban freight transport context are finally considered: (i) the shippers, (ii) the receivers, (iii) the logistics service providers, (iv) the local authorities and (v) the citizens living and consuming in the urban area under consideration (STRAIGHTSOL, 2012a).

## **Stakeholders’ objectives**

The objectives between different groups of stakeholders are diverse and can sometimes be conflicting. Stakeholders try to optimize their activities according to their own interests,

independently of their neighbours' interests (Melo and Costa, 2011). This section explains the different interests of the stakeholders involved.

### *The logistics service provider (LSP)*

The logistics service providers ensure and support the door-to-door transport service required by the shippers and/or the receivers. This stakeholder group includes carriers, express services or other companies providing a logistic service. They can also be the forwarders that organize the logistics and subcontract the carriage of the goods (Stathopoulos et al., 2011). The drivers are also included since they receive some autonomy in routing the delivery before handling the goods (Friedrich et al., 2003). The logistics service providers can be contracted by the shipper for the receiver account or conversely, by the receiver, because transport is not included as part of the shipper's operations. Sometimes, they can be contracted by both shippers and receivers, if shippers and receivers agree on the transfer of risk at one place during transport. The main objective of the LSP is to ensure a positive return on investment and generate profit by providing logistic services. Urban freight transport is therefore organized as efficiently as possible by optimizing vehicle utilization while providing the quality of transport service required by customers, shippers and/or receiver (just-in-time pressure) (PORTAL, 2003). The difficulty is to satisfy both shipper and receiver delivery timing (Melo & Costa, 2011) and to offer high level service. The service is based on the receivers' and shippers' criteria and includes supply chain visibility and punctual deliveries with no damage. New initiatives or measures can have a considerable impact on working conditions of their employees and thoroughly change the way of working. For example, more night deliveries would have a big impact on the social life and sleeping patterns of the drivers. Consequently, logistics service providers are also concerned about worker satisfaction. The logistics service providers of the STRAIGHTSOL demonstration also mentioned their commitment towards reducing emissions, noise levels, visual nuisance and congestion. These concerns were encapsulated in a "green concerns" criterion defined as a positive attitude towards the environmental impact of deliveries.

### *The shipper*

Shippers send the goods from the warehouses they operate. They can be manufacturers, wholesalers or retailers. The goods are then delivered to the receivers who can be the final consumer or an intermediate. Through their interactions, shippers and receivers both act upon the logistics system by influencing the locations where economic activities take place. Because the shippers aim at satisfying the receivers - their customers - by providing a high-level service, shippers and receivers partly share the same interests including, for example, green concerns. Both also want high accessibility between them (Behrends, 2011). High accessibility can be divided into different sub-objectives, but the main aim of shippers and receivers is to keep the cost of logistics as low as possible. The shippers also favour secure, punctual and with damage-free pick-ups. However, to understand this stakeholder group it is important to stress that only the shippers are usually in contact with the transport operators (Dablanc, 2011). They are the customers of the transport operators (Melo & Costa, 2011).

They contract the services of the freight carriers on behalf of the receivers, which are more convenient for the receiver; it makes ordering easier for the receiver, while contributing to the competitiveness of the shippers' product. This results in additional benefits for the shippers, who can determine pick-up time with the transport operators. Delivery time, however, depends more on the freight carriers, who usually decide on what for them is the most efficient time and route to satisfy the receivers. This is especially the case in some supply chains where receivers are big players on the market: receivers most frequently set the time of delivery in mutual agreement with carriers (Melo, 2010).

### *The receiver*

Sometimes the receiver is a consumer who has his or her online purchases delivered at home. But usually the receiver is a professional, for example a retailer, the owner of a bar, restaurant, hotel or factory, a building contractor or an office manager. They could be referred to as city entrepreneurs. The aspiration of the receiver is to be delivered frequently, at low cost and on demand, so stocks can be kept at a minimum. Furthermore real-time information is expected on where goods are prior to their arrival. The receiver also wants to be present when receiving the goods, preferably at a moment when there are not so many customers, which ensures there is time to handle the delivery and there is reduced risk of theft or customer complaints. Consequently, deliveries that do not compromise the receiver's current operations are considered part of a high level deliveries service. Another aim of the receiver is to be located in an attractive urban shopping environment where streets are not cluttered with trucks. Just-in-time operations, however, and the tendency to reduce stock in shops directly increase the frequency of deliveries. The receiver also has green concerns about the environment and the environmental impact of delivery operations.

### *The local authorities*

The local authorities are elected by the citizens to design and manage the physical environment; they represent the interests of the group of stakeholders that include citizens, workers, inhabitants, shoppers, etc. (Dabanc, 2011), but they also pursue their own interests, which are not always directly related to urban freight, but have to be borne kept in mind nevertheless, e.g. the feasibility of enforcing the measures taken. The authorities finance the public infrastructure (e.g. roads, railroads, trucks, etc.) and subsidize some services of public interest. They are also responsible for land planning and regulations parking times, hour zones, and zones for loading and unloading freight. In order to make proper use of the taxpayers' available resources, they aim for optimal use of existing infrastructure and low cost measures to optimize the transport network. Local authorities have to reconcile two conflicting interests. On the one hand, local authorities want the urban environment to be pleasant and attractive for the citizens who elect them and seek to improve the citizens' quality of life. On the other hand, they would like to contribute to a positive business climate and provide an attractive environment for companies. The city should be an attractive location for new shops, offices, bars and restaurants that satisfy consumers and workers, who are also voters. They seek to optimize economic life through

regulations and decrease the negative effects of urban freight traffic, while gaining socio-political acceptance, i.e. citizen support for new measures.

### *The citizens*

The citizen stakeholder category represents society in a broad sense. It includes inhabitants, consumers and commuters. They are usually the end-consumers of the goods entering the city, but are also very much concerned about their living or working environment. As far as they are concerned, trucks and vans are responsible for traffic jams, accidents, noise, and pollution, so they would like to reduce freight transport in their immediate environment to increase urban accessibility, but also reduce the various forms of nuisance (noise, visual). The people employed by the receivers, carriers and suppliers are also part of this stakeholder group. Besides being able to work in an attractive city to work, they hope for a positive impact on road safety (STRAIGHTSOL, 2012a).

## **THEORITICAL STAKEHOLDERS BASED FRAMEWORK**

As mentioned above, the main focus of this framework is on the involvement of stakeholders in the decision process. In Figure 1, the stakeholder-based evaluation framework for city distribution measures is shown. Within the city distribution context, the important stakeholders are the receivers and shippers, the authorities and citizens and the logistics service providers. They interact with one another on different impact domains, i.e. the transport market, the public space and the traffic market in which supply and demand come together. In the transport market the material flow demand is matched by the supply of transport services, resulting in actual goods flows. The vehicle flow resulting from this is matched by the supply of transport infrastructure capacity on the traffic market. In the public space the shippers' demand for locations for their economic facilities is matched with the supply of land by local authorities, who aim for economic settlements in their city-region. Consequently, the stakeholders meet on their common impact domain (Behrends, 2011).

The objectives of the stakeholders are represented on the arcs connecting the stakeholders to which they belong. For example, the quality of life is a criterion shared both by authorities and citizens. In order to be able to properly evaluate the different options, the objectives are measured by selected indicators developed within STRAIGHTSOL describing both the existing situation under consideration and the possible alternatives. The central position of indicators (KPI) stated inside the figure stresses the links with on the one hand, objectives and indicators (simple link), and on the other hand, indicators and methodologies (with a double arrow). Indeed, the indicators provide the necessary input data for the methods used within STRAIGHTSOL and are fully described in (STRAIGHTSOL, 2012b).

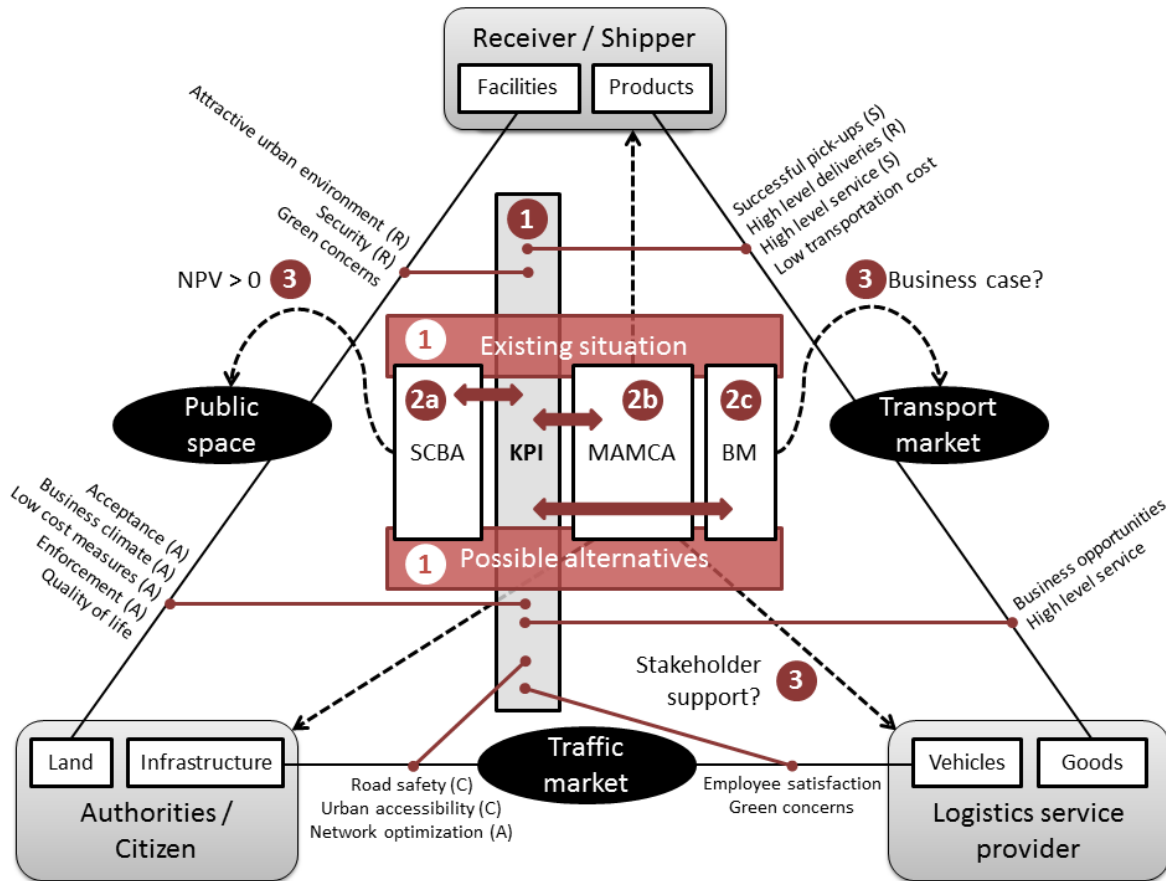


Figure 1 - City Distribution Multi Actor Multi Criteria Analysis (CD-MAMCA), own setup 2012

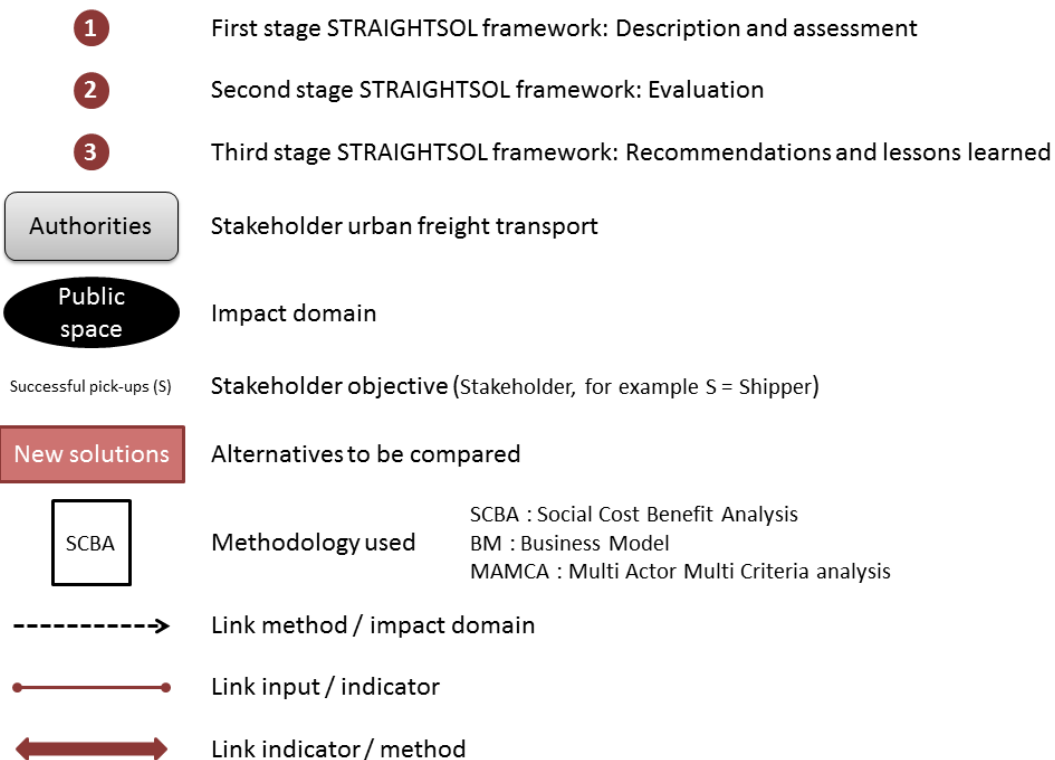


Figure 2 – Legend of CD-MAMCA



## Evaluation methodologies

The evaluation phase of the framework is built upon a combination of three methodologies from the field of welfare theory, marketing and strategic management/operations research. The social cost benefit analysis (SCBA), a Business Model (BM) and a Multi Actor Multi Criteria Analysis (MAMCA) are respectively complementary methodologies that can be used to evaluate the possible alternative distribution concepts. The social cost benefit analysis provides an answer to the societal benefits and costs, whereas a Business Model will look at the desirability of the concept for the private sector. The MAMCA considers the opinions of the different stakeholders and shows the advantages and disadvantages of the new concepts from the point of view of the stakeholders. Thus, the evaluation covers different perspectives, as it 1) looks at benefits and costs for society; 2) assesses the financial viability for the operator; and 3) integrates all the stakeholders' opinions (Table 1). The combination of those methodologies ensures that all essential aspects for project assessment are included in the evaluation. The evaluation phase also enables benchmarking: by comparing the outcome of different alternatives, the best solution for a given situation can be identified.

Table 1 – Evaluation methods within STRAIGHSTOL

<b>Social cost benefit analysis</b>	<b>Business model</b>	<b>Multi Actor Multi Criteria Analysis</b>
Will the concept give more benefits than costs for society?	Will the concept work? Considering financing and value issues	Comparison of alternative solutions from multiple stakeholders' perspectives
<b>Welfare theory</b>	<b>Marketing</b>	<b>Strategic Management/ Operations research</b>

### Social cost benefit analysis

The main goal of a cost benefit analysis is to assess whether investments in a project are justified. Transport projects often appear not to be feasible from a financial point of view since the financial revenues do not make up for the financial costs. The social cost benefit analysis (SCBA), however, goes beyond financial impacts. The SCBA is grounded in welfare theory and takes a wide societal perspective by including the external costs and benefits of transport into the analysis. The impacts of the project on travel times, employment, road safety and environmental pollution, which are not taken into account in a financial analysis, could be important elements to justify the investments. A social cost benefits analysis (SCBA) answers the question whether investment in a project is justified taken all economic costs and benefits for society into account from a welfare economic point of view. This makes a SCBA broader and more appropriate for project justification than a financial analysis that “only” investigates the project’s financial cash flow in order to calculate suitable return rates. Compared to other appraisal methods a SCBA has two main advantages. First, in a SCBA all impacts are as far as possible expressed in monetary terms in order to compare all impacts with each other. Secondly, the SCBA method analyses the impacts of a project on a larger geographical level. Regional redistribution impacts are excluded. This results in a more realistic view on the total impact of a project in terms of national welfare. However, this

compensation criterion of the SCBA can also be seen as a disadvantage. At the end of the process the costs of one stakeholder can be compensated for by the benefits of another. Hence, the redistribution effects for individual shareholders do not clearly emerge from the analysis.

### **Business Model**

A business model describes the value that an organization offers to various customers and portrays the capabilities and partners required for creating, marketing, and delivering this value and relationship capital with a view to generating profitable and sustainable revenue streams (Osterwalder and Pigneur, 2010). A business model is a traditional strategy support tool that describes how an organization creates, delivers, and captures value. The core element of the business model is the product/service that is of value to the identified customer. A business model furthermore encompasses all the elements that are required to make the product/service (i.e. partners, activities and resources) and to deliver it to the customer (i.e. channels and relationships). The Business Model also pays attention to the associated cost structure and the revenue streams in order to identify how the business model generates money for the organization. In the case of urban and inter-urban freight transport, the organisation is related to the logistics service providers. Based on the business models, successful value propositions and requirements for implementation are defined for different urban-interurban transport solutions (STRAIGHTSOL, 2012c).

### **Multi-Actor Multi-Criteria Analysis**

Used as a basis to develop this framework the method enables the point of view of the various stakeholders to be incorporated. The Multi-Actor Multi-Criteria Analysis (MAMCA) is an extension of the existing Multi-Criteria Analysis (for an overview of MCA, see Fandel & Spronk, 1985; Guitoni & Martel, 1998). This methodology allows researchers and decisions makers to evaluate different alternatives (policy measures, scenarios, technologies, etc.) with regard to the objectives of the different stakeholders that are involved in the decision-making process. This way, the MAMCA explicitly includes the stakeholders in the analysis. The methodology was developed by Macharis (Macharis, 2000, 2005 & 2007) and has been used for many applications, mainly in transport-related decision-making problems (for an overview, see Macharis, De Witte & Ampe (2009)).

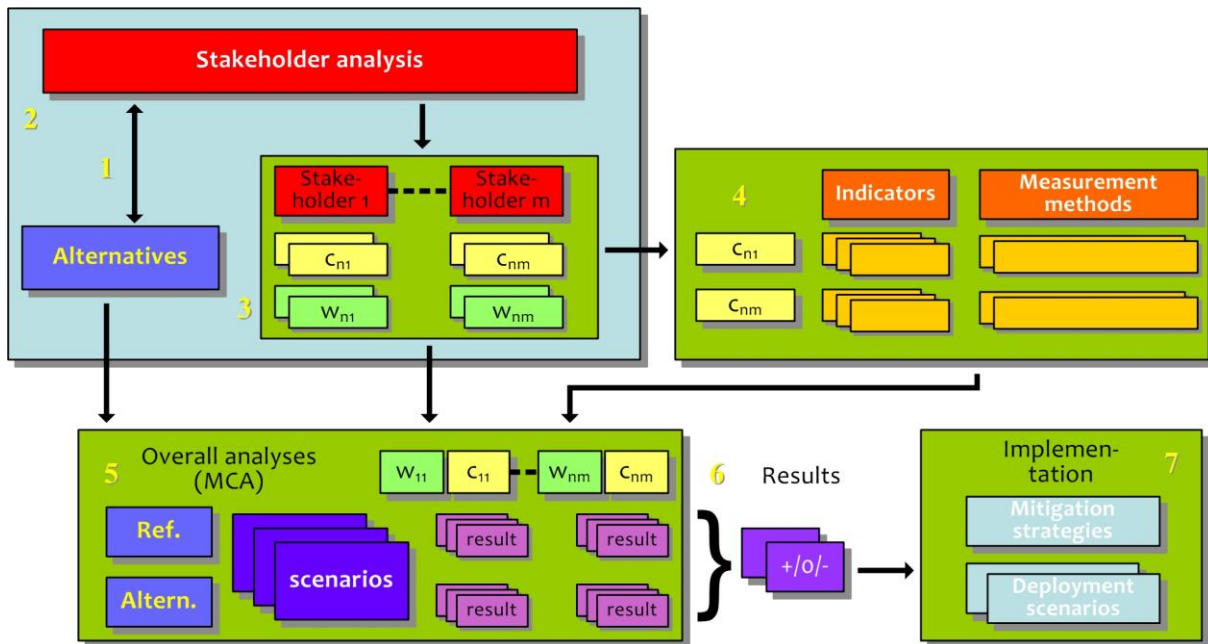


Figure 3- MAMCA (Macharis, 2007)

### *Step 1: Define alternatives*

The first step in the MAMCA approach is the definition of the problem and the identification of the alternatives (step 1). Within STRAIGHTSOL these are the seven demonstration projects and their possible roll-out scenarios. Their evaluation will provide the basis for communicating best practices to other companies and regions in the European urban environment.

### *Step 2: Stakeholder analysis*

The methodology differs from the classical approach of multi-criteria analysis in the explicit introduction of stakeholders in a very early stage (step 2). These stakeholders are the key to identifying the criteria, which here correspond to the objectives of the stakeholders. In the case of the CD-MAMCA, the stakeholders were predefined (see Stakeholders and objectives), but depending on the demonstration it is also possible to adapt them (for example if one stakeholder is not involved).

### *Step 3: Define criteria and weights*

For each stakeholder the criteria are determined on the basis of the aims and objectives of this stakeholder. The weights that have to be given represent the importance the stakeholders attach to these objectives (step 3). For each assessed measure, the positive or negative impacts on the identified criteria (business opportunities, high level service, green concerns, network optimization, etc.) are pointed to and justify the final ranking of the various options that can specify the strong and weak points of each.

A survey was set up to elicit the weights for each stakeholder group. As weights assessment may highly impact the final outcome, special attention was paid to the survey settings and chosen methodology (Saaty, 1990). The complete results can be found in (STRAIGHTSOL, 2012a). The allocation of weights is illustrated in Figure 4 and Figure 5, respectively for the local authorities (public sector) and the logistics service providers (private sector). The vertical axis represents the criteria weights expressed in percentage and computed by pairwise comparison (Saaty, 1990). In order to ensure that the stakeholders' judgements are consistent the different pairwise comparisons were cross-checked with the use of Saaty's inconsistency ratio. The demonstrations, represented by the name of the demonstrators, are on the horizontal axis. The different trends through all the demonstrations can be identified. The number of accurate respondents is also presented. In some cases, the responses of only a few people are needed because the number of people within that stakeholder group is rather small. This is usually the case for the local authority stakeholder group. For the STRAIGHTSOL demonstrations, this is also the case for the logistics service provider, who is often the initiator of the demonstration. When such is the case, the opinions and assessments of these people are also clearly demo-specific. Consequently, the response rate for these stakeholder groups can be low depending on the specific demonstration.

Local authority' representatives were surveyed on six identified criteria (Figure 4). According the ranking, the local authorities attach a great importance to the quality of life and social political acceptance. On average, there is no significant difference between positive business climate, enforcement and network optimisation. Compared to the goal quality of life, local authorities attach much less importance to the cost of a measure.

It is also possible to see the particularity of each demonstration according to a particular stakeholder group. As an example the cost of the measures is not the least important for Greek local authorities (K+N). The higher priority has been given to social political acceptance. The explanation could be the current economic situation in Greece.

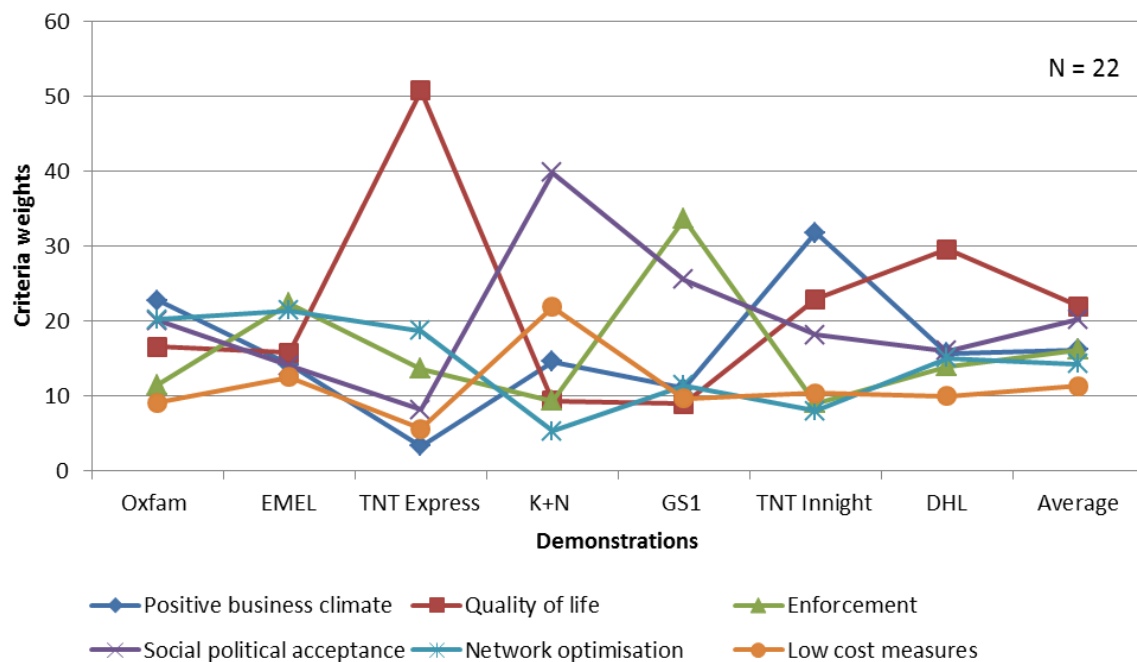


Figure 4 – Weights allocation by local authorities (STRAIGHTSOL, 2012a)

For some of these demonstrations, a stakeholder group may occasionally be missing or the number of respondents may be very low. There are several possible reasons for this:

- The stakeholder group itself may not be represented in a specific demonstration
- The stakeholders have not yet been identified because the demonstration is still at an early stage

Consequently, if there is no input from a particular stakeholder each criterion is given the same weight. This is the case for TNT Express and DHL logistics service providers' demonstrations. On average, the viability of investment is highest and employee satisfaction lowest for logistics service providers (Figure 5). Their first point of interest concerns the economic domain with the viability of investment and the profitability of operations. The third criterion is to provide a high level service. Green concerns and employee satisfaction are considered as less important for the majority of the demonstrations. As remarkable values, one can underline the importance attached to green concerns for the Oxfam demonstration and the TNT Innight demonstration.

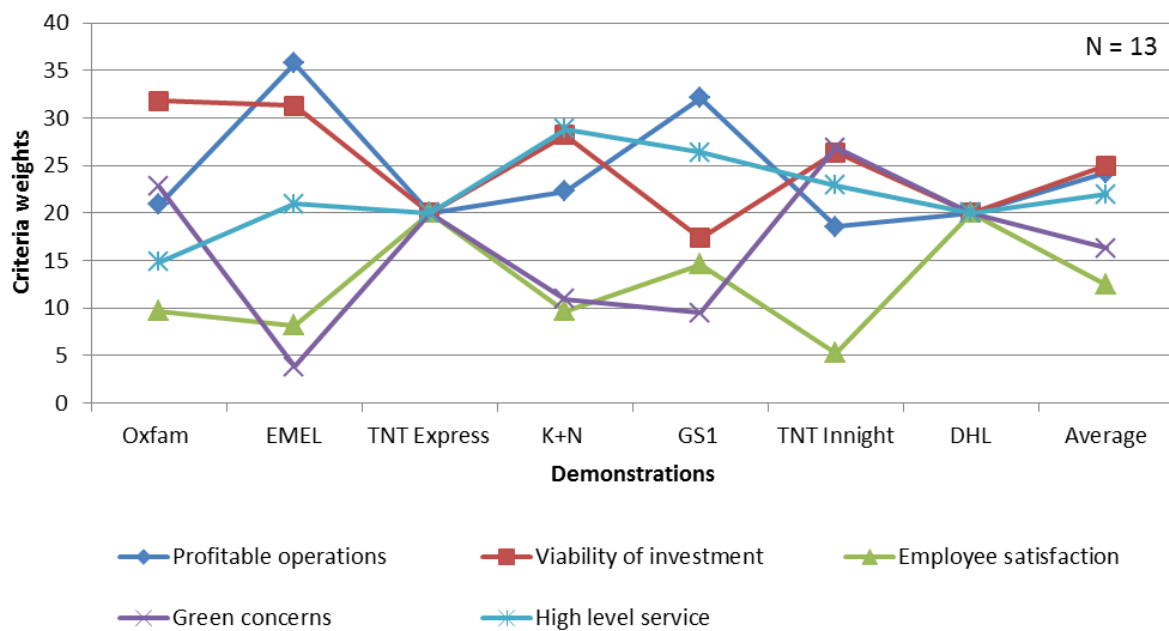


Figure 5 – Weights allocation by logistics service providers (STRAIGHTSOL, 2012a)

#### *Step 4: Criteria, indicators and measurement methods*

In the fourth step, for each criterion, one or more indicators are constructed. The measurement method for each indicator is also made explicit (STRAIGHTSOL, 2012b). This allows the performance of each alternative to be measured in terms of its contribution to the objectives of specific stakeholder groups. Steps 1 to 4 can be considered as mainly analytical, and they precede the 'overall analysis', which takes into account the objectives of all stakeholder groups simultaneously and is more 'synthetic' in nature.

#### *Step 5: Overall analysis and ranking*

Any Multi-Criteria Decision-Analysis (MCDA) method can be used to assess the different strategic alternatives. In fact, the second generation multi-criteria analysis methods, the

Group decision support methods (GDSM), are well suited for use in the MAMCA methodology as they are able to cope with the stakeholder concept. The PROMETHEE GAIA method has, for example, been extended in (Macharis, Brans, & Mareschal, 1998), the Analytical hierarchy process (AHP) method in (Saaty, 1988) and ELECTRE in (Leyva Lopez, 2010). These GDSM methods give each stakeholder group the freedom of having their own criteria, weights and preference structure, and only at the end of the analysis are the different points of view confronted.

### *Step 6: Results*

Next, the MCDA yields a ranking of the various alternatives and reveals the strengths and weaknesses of the proposed alternatives. The results will identify who is in favour of the implementation of the city distribution concept and who may not be. The stability of the ranking can be further assessed through a sensitivity analysis.

### *Step 7: Implementation*

The last stage of the methodology (step 7) includes the actual implementation. When the decision is made, steps have to be taken to implement the chosen alternative by creating deployment schemes. The information on the points of view of each stakeholder received from the previous steps indeed helps the implementation paths to be defined.

## **STRAIGHTSOL STAGE ORIENTED APPROACH FRAMEWORK FOR CITY DISTRIBUTION**

Together with the stakeholder based framework (Figure 1), a more step-by-step oriented impact-assessment framework has been developed in order to reach with a pragmatic approach for future users, using three stages, namely Description and assessment, Evaluation, Recommendations and lessons learned (Figure 6).

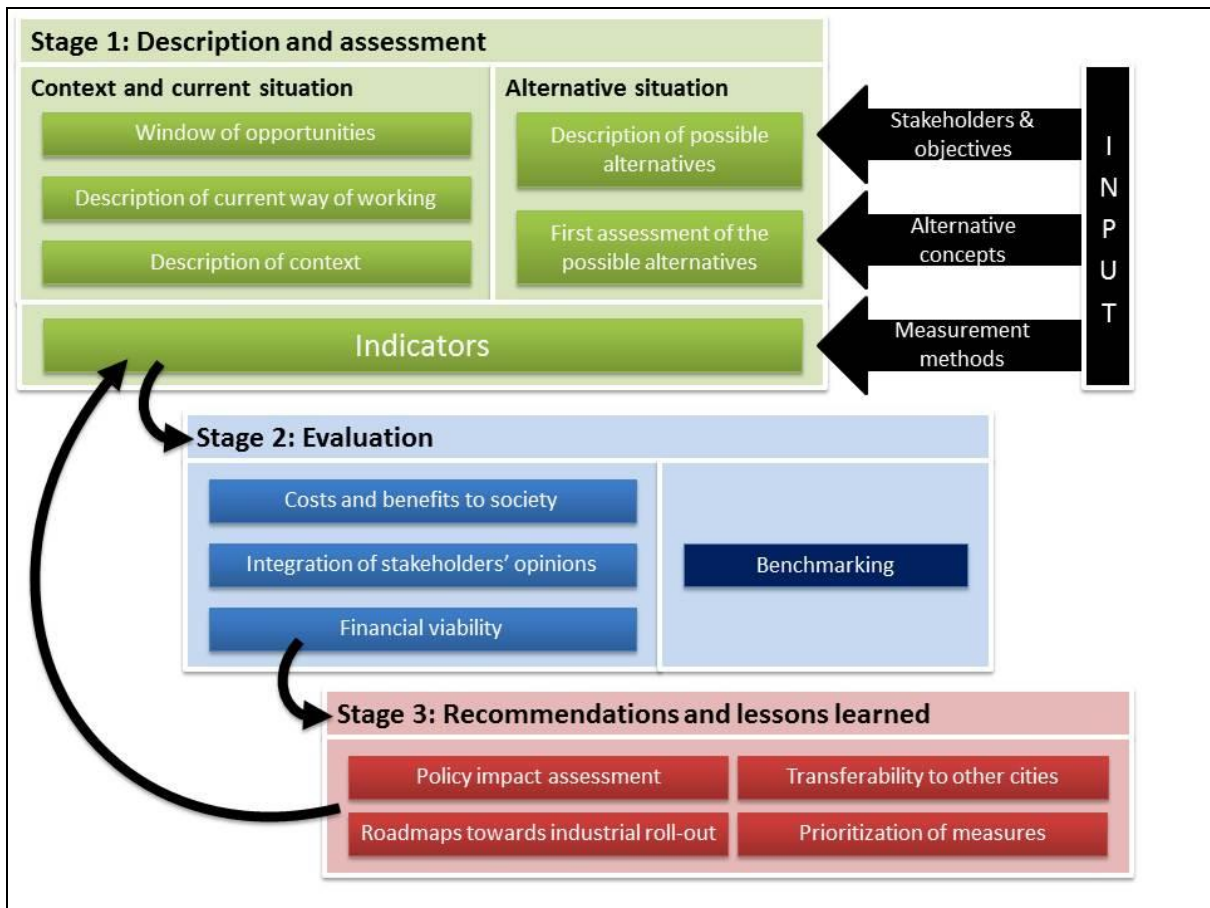


Figure 6 - STRAIGHTSOL framework, 2012

## Preliminary work

First of all this STRAIGHTSOL framework is fed with the necessary input to cover the detailed list of stakeholders and their objectives (see CD-MAMCA, Figure 1). Also, a state of the art of the alternative concepts is done at a preliminary stage. Even if the framework primarily bases its evaluation on new field data, a complete toolbox of measurement methods has been developed to be able to measure the essential indicators such as the Life Cycle Assessment (LCA) (Van Mierlo et al., 2011), Life Cycle Cost Analysis (LCC)(Lebeau, Turcksin et al, 2011), Logistics Systems Analysis Methodology (LSAM) (Daganzo, 2005) and External Cost Calculations (Bickel and Friedrich, 2005). A description of these tools can be found in (STRAIGHTSOL, 2012c).

## Stage one: Description and assessment

The first stage aims to first identify the context and the current situation and second, to explore possible alternatives to the current situation. In the first stage, a good understanding of the current way of working allows the window of opportunities to be defined that explains why the initiative-taking actor wants to find a better alternative way of working. Also, to develop attainable alternatives the fixed context in which they might be implemented has to be clear. Knowing the fixed regulations that are in force will help develop successful

alternatives. Therefore, the second part of this stage describes the alternative situations and provides a first comparison of the current way of working and the various alternatives. A set of indicators has been developed to both characterize the current situation and the alternatives (STRAIGHTSOL, 2012b). These indicators are categorized according to the impact area to allow for a more efficient evaluation process with the distinction of four impact areas: economy, environment, society, and transport. A data collection template is provided as well (STRAIGHTSOL, 2012c).

## **Stage two: Evaluation**

The second stage performs the overall evaluation with the combination of the three methodologies, i.e. SCBA, Business Model and MAMCA described in the previous section. This aims to integrate the stakeholders' opinions, to examine the financial viability of the alternatives and to look at costs and benefits to society. Moreover the common set of indicators allows benchmarking to be performed.

## **Stage three: Recommendations and lessons learned**

The last stage of the STRAIGHTSOL framework gives recommendations for large-scale implementation throughout Europe. The outcome of this stage enables decision makers to mutually compare specific measures or initiatives. The coherent indicator set linked with concrete application allows for a system that enables mutual comparison of various measures and their effects, thereby prompting authorities to look beyond their borders in order to find interesting concepts. This allows the authorities to learn what is important for each of the actors concerned and to define implementation paths that take these points into consideration. This stage will furthermore describe the steps that are required to move from a demonstration to a large-scale implementation and to reach long-term objectives. It will also enable the different actors to plan and coordinate the further deployment of measures and to make the innovation happen. Each time the three-stage cycle is completed new opportunities may arise. This is when lessons are identified and the cycle restarts assessing new solutions that ensure the repeatability of the cycle. The experiences obtained through the living demonstrations of the STRAIGHTSOL project (STRAIGHTSOL, 2012d) and the analysis of impacts aim to boost the future prioritizing of measures in Europe and provide an overview of lessons learnt with regard to developing and testing urban-interurban concepts.

## **CONCLUSION**

The STRAIGHTSOL framework provides a step-by-step approach for a thorough evaluation of city distribution projects. Decision makers' preferences are now taken into account in the evaluation at each stage of the decision process, thereby increasing the chances of success of any initiative. It is crucially important for a MAMCA to achieve a thorough understanding of the problem along with a definition of the various alternatives, the different stakeholders and their objectives. This paper deals with these aspects and aims to provide the framework for a MAMCA devoted to urban and inter-urban freight transport called CD-MAMCA. It determines



the five relevant stakeholders and their objectives. As this paper aims to set up the general framework together with a city distribution MAMCA, only the first steps of the methodology, i.e. stakeholders and criteria are dealt with. This impact assessment framework (STRAIGHTSOL, 2012c) will be fully applied to seven live demonstrations during 2013 and 2014. The impact assessment framework and the experiences obtained through the demonstrations will also contribute to the transfer of knowledge and experiences across Europe and will facilitate the systematic assessment of measures.

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