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CBA Tool: An Overview

The CBA Tool version v1.0 has been developed for the project KITE\(^1\) – A knowledge base for Intermodal Passenger Travel in Europe. This project has been undertaken within the 6\(^{th}\) Framework Programme of the European Commission.

The main objective of the KITE project is the provision of a knowledge base on intermodal travel in Europe. This knowledge base comprises all relevant information about passenger intermodality, it can be easily accessed and allows stakeholders to develop and evaluate intermodality-related measures. It allows the integration and dissemination of current and future information and data.

The project starts with a compilation and structuring the state of the art on passenger intermodality aiming to identify the main gaps, which have to be addressed, on the transport network, followed by an analysis of the existing statistics and surveys giving an insight overview on the existing and latent market potentials. The next project part develops a strategic approach for the collection of intermodal survey data. The analyses of user needs and implementation requirements, concerning interchange points as well as information and ticketing services, provides a catalogue of measures to foster passenger intermodality. A tailor-made Cost Benefit Analysis (CBA)-technique will allow a better identification of the most important intermodal measures and strategies enabling its assessment.

Finally all collected information will be combined in a well-designed knowledge base structure which is user friendly in terms of search, update and insert relevant details, covering information about user abilities, attitudes and requirements, recommendations for standards regarding intermodal services, information/ticketing and interfaces, as well as a best-options survey on intermodality.

The "CBA Tool" is an output from the WP4 of KITE – “Evaluation of Intermodal Investments and Policies” and is part of D12 together with this user manual (written following the logic of “How to use the CBA Tool”). This tool was designed as decision aid tool supporting the assessment of intermodal investments and measures, being based on a CBA framework.

Given its role in the support of the decision taking, it can be considered as a positive contribution to a common “European” approach for the evaluation of passenger intermodality-enhancement initiatives by assisting policy makers and planning bodies in assessing investments and policies, showing the impacts (costs and benefits) that can be expected through the implementation of measures.

\(^1\) See more information about the project at: [www.kite-project.eu](http://www.kite-project.eu)
By applying the KITE CBA tool it is possible to quantify the impacts of intermodal measures, enabling the evaluation of passenger intermodality and at the end contributing to the enhancement of initiatives/policies/projects.

To have a better understanding of how to apply this CBA Tool it is recommended to consult deliverable D11 of KITE. The CBA framework applied and all the methodological approach is explained in D11.

This user manual of the CBA Tool will help with the correct use of the tool, and it comprises the following chapters.

**Applying the CBA tool**

This report provides the user manual for the application of the CBA tool, in broad terms, the steps that compose it.

According to the state-of-the-art review previously done, the most negative/problematic point of an intermodal chain is the transfer that occurs at the intermodal interchange. In order to perform an evaluation coping with that aspect, a methodology to evaluate the measures in a door-to-door perspective, i.e. analysing the path/route that a person has to do from their origin to their destination was defined. The CBA Tool was also created following that principle.

The key issue underlying its development is centred on the intermodal interchange and analyses the access/egress mode, the long distance mode and the possible paths that can be done inside the facility. This means that it also analyses the services to support the intermodality inside of the intermodal interchange, such as ticket counters, information points, luggage lockers, security checks, shops, etc. Therefore it is possible to apply a measure to a specific step of the intermodal chain, and by comparing the scenario “do something” with the scenario “do nothing”, quantify the general impact that such measure could have.

In the figure below the intermodal chain (Access/Egress mode + Terminal + Long Distance modes) is represented. The CBA Tool was developed to assess the measures like it was a path.
A step consists in the sum of different actions (walk, move on a lift, etc.) between the starting/ending point of the path chosen.

Figure 1 – Intermodal chain

The tool comprises six steps as follows:

Step 1
Create an intermodal interchange

Step 2
Characterize the interchange facility

- General
- Access / Egress Modes
- Service Facilities

Characterisation of the interchange is done according to three levels:

- **General**: Name, type of interchange, location, long distance modes serving it;
- **Access/Egress modes**: urban modes available to access / egress the interchange;
- **Service facilities**: service facilities available at the interchange

Step 3
Additional information on interchange facilities
Allow to describe additional information on transport modes as well as service facilities areas available at the interchange. This step is not compulsory, however it is recommended to be filled in once that data will influence in the attribution of values to PEG/ULWT/Comfort/Security (see chapter 2.3 Assumptions).

**Step 4** Description of journeys /paths under analysis

For this purpose it is considered that one journey can have different paths, and each path can be composed of different steps, as follows:

- **Journey** – Begins at the traveler starting point (e.g. from an access mode/service/long distance) to the ending point (e.g. egress mode/service/long distance). One journey can be described by one or several paths.
- **Path** – The path consist of the different route choices that we want to study (or that we have at the terminal. The different routes within a journey could have different step combinations, different durations (according the different route that we choose).
- **Step** – A step consist in the sum of different actions (walk, on move on a lift, etc.) between the starting/ending point of the path chosen. It was design to be has flexible as possible, according the type of analysis pretended.

**Step 5** Assessment

Correspond to the core step of the tool. The following aspects have to be filled and /or validated:

- Settings like the appraisal period, the discount rate, the value of time, information about the demand etc. have to be defined.
- Default values for the several items are presented, however the user is allowed to edit and change values to others considered more suitable.
- The measure under assessment must be identified as well as the target (where we want to apply it - e.g. a reduction on the walking-transfer distance)

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2 See an example in the glossary.
• Fill the Impact section with the expected results of measure implementation (e.g. duration, PEG, etc...). This depends of the type of measure under assessment, being useful to consult the table of measures included in this deliverable to verify where each measure produces impacts.

• Estimate cost values of implementation should be filled (i.e. access mode fare, tolls, luggage lockers price, implementation cost of the measure, management costs, operation costs, etc.)

Step 6 CBA outputs

- Passenger perspective
- Operator/Manager/Authority perspective
- Society perspective

After the application of the measure the CBA tool calculate the net present value of the measure and quantifies the impact.

Results are presented according to two perspectives/points of view: operator’s/authorities or infrastructure managers and passenger’s point of view. Although the society perspective (i.e. impact on externalities such as congestion, air pollution, global warming, etc.) is already considered in the tool, in the actual version it is not possible to quantify the results (see below current limitations).

Main differences are found in the costs considered. If seen from the operator’s point of view, the transports tickets, tolls, luggage lockers or other costs supported by the users are considered as benefits. From the passenger’s point of view, the implementation/operation/management costs are not considered.

In what concerns the benefits it should be considered that a benefit for the operator is also a benefit for the passenger being this related with the indirect effect resultant from the improvement in the interchange efficiency (i.e. improving the efficiency of the intermodal system is linked to the increase of the benefit for the passenger).

Before starting the manual it is necessary to know the requirements for the installation of the tool.
Requirements for the installation of the tool

The CBA tool was developed in Java given the main advantages of its use. In particular this refers to:

Java is **object-oriented**: programming in Java is centred on creating objects, manipulating objects, and making objects work together. This allows creating modular programs and reusable codes. One of the most significant advantages of Java is its ability to move easily from one computer system to another (**platform independent**). The ability to run the same program on many different systems is crucial to World Wide Web software as it is the intention through its dissemination on the KITE website.

The only requirement for the use the CBA Tool is that you have to install the latest java version. After that you just have to run the tool

The next chapters comprises the user manual itself.
How to use this manual?

This manual is organized in 5 main chapters as described below.

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The final chapter is an Appendix where you can find some glossary for a better understanding.

Note: Some chapters have this type of additional notes that emphasize some aspect that can be a cause of mistakes.
1. How to start

After having installed the latest version of java, the CBA Tool can be started.

This is the first panel that appears - the homepage of the **CBA Tool** - with an explanation about the KITE project and the **CBA Tool**.

![CBA Tool homepage](image)

**Cost-Benefit Analysis Tool**

The CBA Tool has been developed for the project KITE – A Knowledge base for Intermodal Passenger Travel in Europe. KITE is a project developed for the 6th Framework Programme of the European Commission.

The main objective of the KITE project is therefore the provision of a knowledge base on intermodal travel in Europe. This knowledge base will compile all relevant information about passenger intermodality, can be accessed easily and allows stakeholders to develop and evaluate intermodality-related measures. It will allow to integrate and to disseminate current existing and future information and data.

The project starts with a compilation and structuring of the state of the art in passenger intermodality, identifies the gaps to be filled, an analysis of existing statistics and survey data might play an important role. Another project task develops a strategic approach for the collection of intermodality survey data. This analysis of key needs and developments will allow for the development of a common standardized approach to the collection of passenger intermodality data as well as information and planning services provide a catalogue of measures to foster passenger intermodality. A CBA Tool will be designed to allow the user to assess intermodal measures and strategies.

Finally, all collected information will be combined in a well-designed knowledge base structure that allows the user to search, update and complete relevant details. It will come information about user attributes, intermodal routes, recommendations for standards regarding intermodal services, information delivering and interfaces, as well as best-practice options for intermodality.

The CBA Tool is an output of one of the work packages of KITE, with the purpose of the work package being the development of an integrated methodology for the evaluation of intermodal passenger services and/or intermodal technical solutions. Ideally, such methodology would serve as a contribution to a common approach for the evaluation of intermodal services and/or intermodal technical solutions. Ideally, such methodology would serve as a contribution to a common approach for the evaluation of intermodal services and/or intermodal technical solutions. Ideally, such methodology would serve as a contribution to a common approach for the evaluation of intermodal services and/or intermodal technical solutions.

This chapter describes the basis of **HOW TO** create, open and save the intermodal interchange that you want to study.
1.1 Creating an interchange

The starting point of this CBA Tool is creating an interchange.

- Select File > Click New Interchange

After this, you can go directly to chapter 2 and start the characterization of your intermodal interchange.

1.2 Opening an existing interchange

If you already have created an intermodal interchange, you have to:

- Select File > Click Open Interchange
Select the file that you want

Click Open

Figure 4 – How to open an existing interchange?

1.3 Saving the interchange as a file

- Select **File** > Click **Save as**
- Select the directory where you want to save and type in a filename
A step consists in the sum of different actions (walk, move on a lift, etc.) between the starting/ending point of the path chosen.

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**Deliverable D12: CBA Tool User Manual**

Figure 5 – How to save?

Note: You can create several intermodal interchanges within the CBA Tool, but when you save, it is only going to save the one selected. You have to select one by one and do the procedure to save as indicated above.

After creating an interchange, the next chapter describes how to characterize it in order to allow the future application of the measure(s).
2. How to characterize the Intermodal Interchange

2.1 Selection of the transport modes and the available service facilities

After creating an interchange, the next step is to characterize it. It is necessary to fill in the information that is presented in the next three panels in order to allow the future application of the measure(s).

In the first panel, it is necessary to type the name of the interchange, choose the country of its location (e.g. Portugal, Spain, Germany etc.), to add a symbol (picture) of the interchange (optional) and to select the long distance modes that exist at the interchange (see Figure 6).

Figure 6 – Fill in the information about the intermodal interchange
In the next panel it is suppose to select the access/egress modes that exist (see Figure 7).

Finally you have to select the available service facilities of the interchange (see Figure 8).
A step consists in the sum of different actions (walking, moving on a lift, etc.) between the starting/ending point of the path chosen.

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**Figure 8 – Fill in the information about the available service facilities that exists at your intermodal interchange**

The following panel is an example of the transport modes and service facilities of a specific interchange, which is the result from the previous three panels. On the left side you can see the information that you have selected to describe your interchange.
A step consist in the sum of different actions (walk, move on a lift, etc.) between the starting/ending point of the path chosen.

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Figure 9 – Summary of the information that describes the intermodal interchange (e.g. Gare Oriente example)

Note: You can describe the information about your interchange by clicking the Edit button on the right side, but don’t forget to Save it after.
2.2 Description of the conditions of the access/egress modes, long distance modes and the service facilities

This is an optional part of the CBA tool, you do not have to add it, but it is recommended because it will help you to calculate the indicators\(^3\):

- Path Effort Grade (PEG)
- Usage Level of Waiting Time (ULWT)
- Comfort
- Security

These indicators have the goal of converting qualitative aspects (e.g. the conditions of the waiting conditions: location of the room, access to the room, number of seats, climatic conditions, etc) into quantitative ones. To know how this can be done, you have to consult the guidelines of D11.

You have to click on the respective transport mode or service facility that you have on the left side, and after have to click the edit button which enables you to write down the information that you want to.

\(^3\) For further information about how to calculate these indicators, please see D11
A step consists in the sum of different actions (walk, move on a lift, etc.) between the starting/ending point of the path chosen.

Figure 10 – Panel to edit information about a transport mode (e.g. train)

Figure 11 - Panel to edit information about a service facility (e.g. ticket vending machine)

Note: After editing the information don’t forget to Save it.
3. How to describe the journeys and paths within the interchange

The next step of the CBA Tool consists on the description of the journeys (see the Glossary chapter on the Appendix).

In this panel select the number of journeys (click **Create new journey** to add journeys) for which you want to evaluate the impact of a measure.

- **Select From**
  - Access mode/Long distance mode/Service
  - Select the access mode (e.g. train; bus; taxi; private car; pedestrian; bicycle, subway, rental car) or the Long distance mode (e.g. bus, train, ship, aircraft) or the service (e.g. info points, shops, waiting rooms, etc) from the options
  - If in the previous panel a different terminal had been chosen, here you can select the correct terminal

- **Select To**
  - Egress mode/Long distance mode/Service
  - Select the egress mode (e.g. train; bus; taxi; private car; pedestrian; bicycle, subway, rental car) or the Long distance mode (e.g. bus, train, ship, aircraft) or the service (e.g. info points, shops, etc) from the options
  - If in the previous panel a different terminal had been chosen, here you can select the correct terminal

For example, a journey can be considered between the starting point “home” and the ending point “destination”. The starting point can be an access mode (e.g. bus) and the ending point can be an egress mode (e.g. taxi). In this case, in the tool it has to be:

From: Access mode / Select: Bus
To: Egress mode / Select: Taxi

**Note:** You can evaluate the impact of a measure as a one-way journey as From: Access mode (e.g bus) To: Long distance mode (e.g. train).

You can remove journeys if you want by clicking on the Remove button on the right side.
A step consists of the sum of different actions (walk, on move on a lift, etc.) between the starting/ending point of the path chosen.

The second part is to add the paths (see the Terminology chapter on the Appendix).

For each path you have to select the type of action, the duration (e.g. if the action is walk, you can just fill in the distance -in meters- if you do not know how much time the travelers spent), the charge (e.g. can be the taxi fare, the ticket price, the locker price in € / passenger), the demand^4 (passenger/day).

To choose a suitable value to **PEG** (Path effort grade) and/or **ULWT** (Usage level of waiting time) you should consult Deliverable D11 of the KITE project.

You can choose the indicator(s), if any, which best characterize your option, just by ticking them on it and afterwards you can identify the level of importance that each indicator, if any, has on your journey. The indicators are the following:

- **PEG** (move to the right according the increase of the difficulty of the path)

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^4 Please see the chapter of D11 from KITE about the demand. This needs a previous analysis in order to make a good fit to the reality.
- ULWT (move to the right according the increase of the useful time of the waiting time)
- Comfort (move to the right according the increase of the comfort)
- Security (move to the right according the increase of the security)

You can add paths by clicking **Add another path**. When you finish adding paths, you must click on the **Save** button on the bottom of the page, and afterwards you should **Save and Return to Journey** (on the top of the page).

![Figure 13 – Description of the paths](image)

When you return to the panel Journeys, summarized information of the paths will be displayed.
4. How to assess the measures

In this panel you have to choose the **appraisal period** for the assessment of the impact of your measure, the **discount rate**, the value of time (VOT), information about the demand and the other two fields (externalities and the disutility will be used in the next version of the tool). You can use the default values or you can change the values to the ones that best suites your case study.

![Figure 14 – Settings panel](image)

**Note: Do not forget to save settings before you go to the application of the measure**

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5 The default VOT is from the study “Handbook on estimation of external cost in the transport sector”, produced within the study Internalisation Measures and Policies for All external Cost of Transport (IMPACT).
The next panel with the package of measures/measures is optional.

Some measures have higher importance than others, so we can attribute weights to the measures in order to calculate the global value of a package of measures. (Please consult D11 for further information about the application of this panel).

![Figure 15 – Measures panel](image)

The following panel is the part of the CBA where you are going to apply the measure to the path that you want (click on the path to highlight). The procedure is:

- Choose what to assess (e.g. package of measure, a measure or an action);
- Choose the **Target** (e.g. journey or path that you want to study)
- Fill the section **Impacts** with the change that will occur or that already occurred (e.g. variation of the duration of the travel, etc).
In this last section “Impacts”, you are applying the CBA framework, that is why you have to compare the scenarios “do something” (e.g. apply a measure) with the “do nothing” scenario (e.g. current described situation). As a variation you could have a:

- Reduction on the duration of the travel
- Reduction of the distance
- Reduction of the charge
- Increase of the demand
- Decrease of the PEG
- Increase of the ULWT
- Increase of the Security
- Increase of the Comfort

You have to put the costs of the investment/operation/management of the implementation of the measure. The savings represents the amount of money saved with the application of a measure, e.g. could be the amount of money saved with a lower necessity of employees.

The final step is to click the button **Apply measure**. When you click the button Apply measure, the cells will be emptied, which means that the measure was applied successfully.
A step consists in the sum of different actions (walking, moving on a lift, etc.) between the starting/ending point of the path chosen.

**Figure 16 – Apply the measures**
5. Final OUTPUT: Cost Benefit Analysis

This is the output/result of the measure, the CBA summary table.

We can obtain the Net Present Value (NPV) according the passenger or the operator’s point of view (the society’s is already foreseen for the tool, but it is not working in this version).

The net present value (NPV) represents the impact of the measure, if it is positive, you have a positive impact, and if it is negative, it means that your measure does not have a new benefit.

![Figure 17 – Cost Benefit Analysis Output](image-url)
A. Glossary

**Journey** – Begins at the travel starting point (e.g. from an access mode/service/long distance) to the ending point (e.g. egress mode/service/long distance). One journey can be described by one or several paths.

**Path** – The path consist of the different route choices that we want to study (or that we have at the terminal. The different routes within a journey could have different step combinations, different durations (according the different route that we choose).

**Step** – A step consist in the sum of different actions (walk, on move on a lift, etc.) between the starting/ending point of the path chosen.

Example:

![Diagram](image)

Journey between the starting point “home” and the ending point “destination”. In this example, the starting point is an access mode = bus and the ending point is an egress mode = taxi.

**From:** Access mode / Bus  
**To:** Egress mode / Taxi

In this example we want to study just one possible path/route (called Path 0) between the bus and the taxi, which is composed by the following steps:

**Path 0** is composed by:
Step 0: Bus
Step 1: Walk
Step 2: On move on a lift
Step 3: Waiting room
Step 4: Long distance mode – train
Step 5: Walk
Step 6: Taxi

There is the possibility to have several paths between the bus and the taxi by varying the steps, for example:

**Path 1:**
Step 0: Bus
Step 1: Walk
Step 2: Waiting room
Step 4: Long distance mode – bus
Step 5: Walk
Step 6: Taxi

**Cost Benefit Analysis (CBA)** - Cost-benefit analysis is a formal analysis of the impacts of a measure or program, designed to assess whether the advantages (called benefits) of the measure or program are greater than its disadvantages (called costs). Cost-benefit analysis is one of a set of formal tools of efficiency assessment, which allows determining how to use scarce resources to obtain the greatest possible benefits of them.

**Appraisal period** – the year(s) in which the benefits and costs occur

**Discount rate** - When you want to compare costs and benefits that occur in different time periods, discounting is the method used. The purpose of discounting is to express in present values the flow of costs and benefits involved in a project lifetime – or a determined appraisal period. Once the set of future values are expressed in present values they are comparable.

Therefore, one of the central concepts of the cost-benefit analysis is that the costs and the benefits resulting out of the political decision have to be discounted on one period (the same period). This mean a cost or benefit of X euro appearing in the year T has a capital value of \( X/(1+r)^T \), to the present year \( t=0 \).
NPV – Net present value can be calculated as:

\[ NPV = \sum_{n=0}^{N} \frac{(b_n - c_n)}{(1+r)^n} \]

Where:
- \( b \) = project benefits
- \( c \) = project costs
- \( n \) = the year(s) in which the benefits and costs occur – appraisal period
- \( r \) = discount rate