

Distr.: General  
25 January 2013

ENGLISH ONLY

---

## **Economic Commission for Europe**

Inland Transport Committee

### **Working Party on Customs Questions affecting Transport**

**Informal Ad hoc Expert Group on Conceptual and  
Technical Aspects of Computerization of the TIR Procedure**

**Twenty-second session**

Geneva, 30-31 May 2013

Item 5 of the provisional agenda

**Financial implications of the introduction of the eTIR international system**

## **Cost Benefit Analysis of the eTIR system: summary, limitations and recommendations**

**Note by the secretariat**

### **I. Background**

1. At its forty-eighth session, further to requests from the Inland Transport Committee (ITC), WP.30 and Informal Ad hoc Expert Group on Conceptual and Technical aspects of Computerization of the TIR Procedure (GE.1; hereinafter referred to as “Expert Group”), the TIR Executive Board (TIRExB) mandated the secretariat to conduct a Cost Benefit Analysis (CBA) of the eTIR Project (TIRExB/REP/2011/48final para. 10). Consequently, taking into account the funds available in the TIRExB consultancy budget line and the task to be undertaken, the TIR secretariat requested the relevant services of the United Nations Office at Geneva (UNOG) to issue a tender. In line with the applicable United Nations procurement principles, rules and procedures, UNOG sent out a request for quotes to five companies. Two companies submitted a bid, which were evaluated. Subsequently, the contract was awarded to the qualified bidder, whose bid substantially conformed to the requirements set forth in the solicitation documents and who had been evaluated as being most cost-efficient for the United Nations.

2. At its twentieth session, the Expert Group welcomed the draft CBA, presented in Informal documents GE.1 No. 6a, 6b, 6c, 6d and 6e (2012). The Expert Group expressed its general consent with the methodology used by the consultants, while, at the same time, raising preliminary comments with regard to various assumptions used by the consultants in the course of the CBA. Inter alia, the Expert Group was of the opinion that the two scenarios described in the CBA (gradual introduction of eTIR Carnets versus the one time

replacement of the paper TIR system by an electronic system, the so-called “big-bang” scenario) were too optimistic and requested the unrealistic “big-bang” scenario, to be replaced by a more pessimistic (read: more realistic) one. In reply to suggestions that the scenarios used should be based on complex forecasts on the long-term development of transport flows between TIR Contracting Parties, the secretariat recalled that the CBA had been adjudged to the consultants on the basis of a clear mandate and with a limited budget and that, therefore, it was unrealistic to expect them to undertake such complex simulation exercise, in addition to their work so far. To wrap up its initial discussions on the issue, the Expert Group requested additional time in order to provide the secretariat in writing with its comments on the draft CBA and proposed that eTIR focal points would also be given the opportunity to submit their contributions. Further to this request, the secretariat sent an email to eTIR focal points, soliciting their considerations on the draft CBA.

3. On the basis of all comments received, the consultants prepared an updated version of the CBA, which was presented as Informal Document No. 12 at the Expert Group’s twenty-first session. The Expert Group took note that, apart from apparent mistakes in the calculations and lack of textual consistency, the CBA was final. The Expert Group agreed on the methodology used by the consultants, but felt that some costs, e.g. training, and indirect benefits were missing from the calculations. The Expert Group agreed with the proposal by the secretariat to prepare a revision of Informal document No.12, correcting all remaining mistakes, for circulation among the network of eTIR focal points. Furthermore, it requested the secretariat to prepare this document, for consideration at its next session, containing a summary of the consultants’ CBA, in combination with an assessment of the limitations of the analysis, i.e. the missing costs and benefits, as well as recommendations.

## **II. Summary of the Cost Benefit Analysis**

### **1. Disclaimer**

4. The CBA, as contained in Informal document GE.1 No.12 Rev.1 (2012), reflects the views of the consultants and not those of the UNECE secretariat. The UNECE secretariat’s contribution has been limited to ensuring that the CBA methodology has been properly applied and preparing the underlying summary.

### **2. Objective and methodology**

5. The main objective of the eTIR CBA is to compare the costs and the benefits of the implementation of an eTIR system under various assumptions, exploring different technological options and assuming different scenarios over a period of twelve years, i.e. two years for the development and deployment of a centralized exchange platform (the “so-called” eTIR international system), followed by ten years of progressively increased usage. In line with standard CBA methodology, costs and benefits are discounted to allow their comparison at present value. For the purpose of the eTIR CBA, a discount rate of 5% is used. Returns on investment (ROI) and Net Present Values (NPV) are used to compare the various technological options.

6. The assumptions are based on various sources, e.g. the eTIR Reference Model, as well as the consultants’ expertise in the field of information and communication technology (ICT) projects, in particular software development projects.

### 3. Technological options

7. The CBA identifies six technological options to implement a centralized eTIR international system.

- **At premises:** a completely new data centre will be established to host the eTIR international system. This implies the purchase and maintenance of a completely new data centre (space, network, hardware and software).
- **UNOG:** the eTIR international system will run on machines that will be hosted by and maintained at the United Nations at Geneva (UNOG) data centre.
- **UNICC:** the eTIR international system will run on machines that will be hosted by and maintained at the United Nations International Computing Center (UNICC) data centre.
- **IaaS (Infrastructure as a Service):** the eTIR international system will run on a shared infrastructure in the cloud<sup>1</sup>.
- **PaaS (Platform as a Service):** the eTIR international system will run on a shared platform in the cloud.
- **SaaS (Software as a Service):** the eTIR international system will be provided as a service by a cloud provider.

8. The technical assessment, presented in Annex of the CBA, identifies PaaS as the best option, followed by UNOG and UNICC.

### 4. Scenarios

9. The CBA considers two different scenarios over a period of 12 years. It is assumed that, at the end of this period, all 57 Contracting Parties (CP) to the TIR Convention would have upgraded their Customs IT systems to ensure the connectivity with the eTIR international system, according to the following schedule:

Year	1	2	3	4	5	6	7	8	9	10	11	12
N° of CP		3	3	3	5	10	10	5	5	5	4	4

Table 1. Annual number of Contracting Parties upgrading their IT system

10. The two scenarios differ from each other by the number of TIR transports that would be handled solely electronically every year, i.e. making full use of the eTIR international system. In the first scenario, the number of computerized TIR transports would gradually reach the current annual number of TIR Carnets used (approx. 3 million). In the second scenario, only half of those would be computerized after the twelfth year. The following table shows the annual number of computerized TIR transports for both scenarios.

Year	1	2	3	4	5	6	7	8	9	10	11	12
Scenario 1			100	700	800	1200	1300	2000	2500	2600	2800	3000
Scenario 2			50	300	400	500	600	1000	1200	1300	1400	1500

Table 2. Number of fully computerized TIR transports (thousands)

<sup>1</sup> The term “cloud” refers to the concept of cloud computing, i.e. the usage of (shared) computing resources (hardware and software) made available by specialized companies as services over the Internet.

## 5. Costs

11. The following costs categories are considered:

- Development costs;
- Initial costs;
- Operational and hosting costs;
- Helpdesk costs;
- Costs to adapt national applications.

12. For each cost category, minimal and maximum costs are estimated.

### a. Development costs

13. The development costs of the three components of the eTIR international system have been estimated separately:

- (i) the kernel (ensuring the electronic exchange of eTIR messages),
- (ii) the web base user interface, which would serve as backup to the kernel, and
- (iii) the administration console.

14. The system dimension of each component has been estimated by means of a function point analysis (FPA) and adjusted on the basis of an estimated processing complexity. On that basis (and by using the Constructive Cost Model (COCOMO) II methodology), the development costs and schedule have been estimated. The development costs of the entire eTIR international system range between 924,800 and 1,127,000 USD.

### b. Initial Costs

15. Setting up the eTIR international system will require different costs, depending on the technological options selected. Table 3 presents the minimum and maximum estimated initial costs for each option. They include, but are not limited to, purchasing facilities, hardware and software, as well as training and recruitment activities.

	Min	Max
At premises	1,255,000	1,450,000
UNOG	681,500	792,500
UNICC	632,000	743,000
IaaS	632,000	743,000
PaaS	142,000	183,000
SaaS	10,000	15,000

Table 3. Initial costs (USD)

### c. Operational and hosting costs

16. Operating and maintaining the eTIR international system will imply annual costs. Most of those costs depend on the number of TIR transports that will be handled by the system. The costs will also vary greatly, depending on the technological options selected. Table 4 presents the minimum and maximum estimated annual variable costs for each option, in case 3 million TIR transport would be handled by the system. Variable costs include, depending on the option, costs for testing, backup, staff, training, audit, insurance and management as well as fees paid to cloud operators.

	Min	Max
At premises	340,419	526,059
UNOG	194,739	243,259
UNICC	167,719	257,059
IaaS	113,402	153,126
PaaS	159,116	180,816
SaaS	1,500,000	3,000,000

Table 4. Annual operational and cloud costs (USD)

17. By means of dividing the above mentioned costs by 3 million, a unit cost operational and cloud cost per TIR transport has been calculated. On that basis, the annual variable costs for each scenario have been estimated.

**d. Helpdesk costs**

18. In accordance with the requirements contained in the eTIR Reference Model only a minimal helpdesk is required, the main function of which it is to assist countries in connecting their IT systems to the eTIR international system. Such a helpdesk would be composed of 2 IT specialists, working 40 hours a week. The initial costs to establish such a helpdesk would range from 24,500 to 44,000 USD. The operating and personnel costs have been estimated between 126,180 and 216,600 USD per annum.

**e. Costs to adapt national applications**

19. It is assumed that countries already have, or will anyway, develop IT systems that process TIR operations nationally or regionally. Therefore, the only costs that have been assessed are aimed at;

- (i) ensuring that all information required by the eTIR international system can be entered and stored in the national IT system;
- (ii) integrating eTIR web services in the national applications handling TIR operations and
- (iii) developing the interfaces (web services) required by the eTIR international system.

On the basis of an estimated project plan, adapting national Customs IT system would cost between 120,000 and 150,000 USD per country.

**e. Other costs**

20. The consultants have considered that there would be no other costs, including from the trader/transport community.

**6. Benefits**

21. A fully computerized TIR system will generate direct annual benefits for Customs, the guarantee chain and holders. The various benefits have been estimated independently, before calculating the average benefits of computerization per TIR transport.

**a. For Customs**

22. The direct benefits for Customs have been derived from the comparison between the time required to process a paper based TIR Carnet and the estimated time it would take to process the equivalent electronic information, once the system would be fully

computerized. Taking also into account that some Customs administrations already now receive information in an electronic form and that not all time reductions will lead to actual saving in personnel costs, the savings for Customs administrations are estimated at 4,311,428 USD per annum, in case 3 million TIR transports are computerized.

**b. For the guarantee chain**

23. The guarantee chain's costs related to printing, distribution and archiving of TIR Carnets are estimated at 2 USD per TIR Carnet, resulting in potential savings of 6 million USD per year, in case the entire TIR system becomes paperless.

**c. For the holders**

24. The benefits for the holders, resulting from the reduction in time to begin a TIR transport (i.e. difference between the time to fill in a paper TIR Carnet and the time to input data electronically) as well as the reduction in time spent at borders could reach 16,437,504 USD per annum.

**7. Results of the CBA**

24. In order to include a factor of incertitude (inherent to such a large scale project) into the analysis, a 20% risk ratio to both costs and benefits has been introduced, i.e. costs have been increased by 20% and benefits decreased by 20%. On the basis of the risk-adjusted and discounted costs and benefits, the annual cash flows, ROI and NPV have been calculated for each technological option and for both scenarios over a 12 years period. Tables 5 and 6 present the final results of the CBA of the eTIR system.

		Premises	UNOG	UNICC	PAAS	IAAS	SAAS
Costs	Development	1,127,000	1,127,000	1,127,000	1,127,000	1,127,000	-
	Initial	1,450,000	792,500	743,000	183,000	743,000	15,000
	Oper. + Hosting	2,981,001	1,378,468	1,456,668	1,024,624	867,717	17,000,000
	<i>Sub-total</i>	<i>5,558,001</i>	<i>3,297,968</i>	<i>3,326,668</i>	<i>2,334,624</i>	<i>2,737,717</i>	<i>17,015,000</i>
	Help Desk	2,210,000	2,210,000	2,210,000	2,210,000	2,210,000	2,210,000
	National App	8,550,000	8,550,000	8,550,000	8,550,000	8,550,000	8,550,000
<i>Total Costs</i>		<i>16,318,001</i>	<i>14,057,968</i>	<i>14,086,668</i>	<i>13,094,624</i>	<i>13,497,717</i>	<i>27,775,000</i>
<i>Total Costs (incl. 20% risk factor)</i>		<i>19,581,601</i>	<i>16,869,561</i>	<i>16,904,001</i>	<i>15,713,549</i>	<i>16,197,260</i>	<i>33,330,000</i>
<i>Discounted Costs (incl. risk factor)</i>		<i>14,979,069</i>	<i>12,941,676</i>	<i>12,950,077</i>	<i>12,391,640</i>	<i>12,470,894</i>	<i>23,464,073</i>
<i>Benefits for Customs (incl. 20% risk factor)</i>		<i>19,550,000</i>	<i>19,550,000</i>	<i>19,550,000</i>	<i>19,550,000</i>	<i>19,550,000</i>	<i>19,550,000</i>
<i>Total Benefits (incl. 20% risk factor)</i>		<i>121,210,000</i>	<i>121,210,000</i>	<i>121,210,000</i>	<i>121,210,000</i>	<i>121,210,000</i>	<i>121,210,000</i>
<i>Discounted Customs Benefits (incl.risk factor)</i>		<i>13,255,247</i>	<i>13,255,247</i>	<i>13,255,247</i>	<i>13,255,247</i>	<i>13,255,247</i>	<i>13,255,247</i>
<i>Discounted Overall Benefits (incl.risk factor)</i>		<i>82,182,532</i>	<i>82,182,532</i>	<i>82,182,532</i>	<i>82,182,532</i>	<i>82,182,532</i>	<i>82,182,532</i>
ROI for Customs		-12%	2%	2%	7%	6%	-44%
<b>Overall ROI</b>		<b>449%</b>	<b>535%</b>	<b>535%</b>	<b>563%</b>	<b>559%</b>	<b>250%</b>
<b>Net present value</b>		<b>67,203,464</b>	<b>69,240,856</b>	<b>69,232,456</b>	<b>69,790,892</b>	<b>69,711,639</b>	<b>58,718,460</b>

Table 5. Costs, Benefits, ROI and NPV for scenario 1 (USD)

		Premises	UNOG	UNICC	PAAS	IAAS	SAAS
Costs	Development	1,127,000	1,127,000	1,127,000	1,127,000	1,127,000	-
	Initial	1,450,000	792,500	743,000	183,000	743,000	15,000
	Oper. + Hosting	2,981,001	668,962	706,912	497,244	421,098	8,250,000
	<i>Sub-total</i>	5,558,001	2,588,462	2,576,912	1,807,244	2,291,098	8,265,000
	Help Desk	2,210,000	2,210,000	2,210,000	2,210,000	2,210,000	1,286,300
	National App	8,550,000	8,550,000	8,550,000	8,550,000	8,550,000	8,550,000
	<i>Total Costs</i>	<i>16,318,001</i>	<i>13,348,462</i>	<i>13,336,912</i>	<i>12,567,244</i>	<i>13,051,098</i>	<i>18,101,300</i>
	<i>Total Costs (incl. 20% risk factor)</i>	<i>19,581,601</i>	<i>16,018,155</i>	<i>16,004,295</i>	<i>15,080,693</i>	<i>15,661,317</i>	<i>21,721,560</i>
	<i>Discounted Costs (incl. risk factor)</i>	<i>14,979,069</i>	<i>12,362,151</i>	<i>12,337,675</i>	<i>11,543,030</i>	<i>12,523,940</i>	<i>15,492,843</i>
	<i>Benefits for Customs (incl. 20% risk factor)</i>	<i>9,487,500</i>	<i>9,487,500</i>	<i>9,487,500</i>	<i>9,487,500</i>	<i>9,487,500</i>	<i>9,487,500</i>
	<i>Total Benefits (incl. 20% risk factor)</i>	<i>58,822,500</i>	<i>58,822,500</i>	<i>58,822,500</i>	<i>58,822,500</i>	<i>58,822,500</i>	<i>58,822,500</i>
	<i>Discounted Customs Benefits (incl.risk factor)</i>	<i>6,406,022</i>	<i>6,406,022</i>	<i>6,406,022</i>	<i>6,406,022</i>	<i>6,406,022</i>	<i>6,406,022</i>
	<i>Discounted Overall Benefits (incl.risk factor)</i>	<i>39,717,335</i>	<i>39,717,335</i>	<i>39,717,335</i>	<i>39,717,335</i>	<i>39,717,335</i>	<i>39,717,335</i>
	ROI for Customs	-57%	-48%	-48%	-45%	-49%	-59%
	<b>Overall ROI</b>	<b>165%</b>	<b>221%</b>	<b>222%</b>	<b>244%</b>	<b>217%</b>	<b>156%</b>
	<b>Net present value</b>	<b>24,738,266</b>	<b>27,355,184</b>	<b>27,379,660</b>	<b>28,174,305</b>	<b>27,193,395</b>	<b>24,224,492</b>

Table 6. Costs, Benefits, ROI and NPV for scenario 2 (USD)

25. Finally, the profitability of the project for single Customs administration has been assessed, indicating that, from the moment that approximately 30,000 TIR operations per year are fully computerized, the investment in both the eTIR international system and the costs to adapt a national IT system become profitable.

## 7. Conclusions and recommendations

25. Combining their technical assessment with the results of the CBA, the consultants have made the following conclusions and recommendations:

- The eTIR system should be implemented as soon as possible to maximize its benefits;
- The best technical option to implement the eTIR international system is to use a Platform as a Service (cloud solution), closely followed by Iaas, UNICC and UNOG options;
- In scenario 2, even if the project does not have a positive ROI for Customs alone, it remains a very profitable project overall.
- Processing annually 30,000 TIR operations electronically is sufficient to justify the investment in eTIR for any single Customs administration.

## III. Assessment of the Cost Benefit Analysis by the secretariat

### 1. Scope

#### a. General

26. As highlighted by the Expert Group, when analysing earlier versions, the CBA does, unfortunately, not take into account any indirect benefits related to the computerization of the TIR system. Indirect benefits can range from increased transport facilitation (due to the availability of advance information) to, ultimately, increased security of the TIR system, which is beneficial to both Customs and the guarantee chain.

27. Furthermore, contrary to the consultants' assumption, both transport operators and the guarantee chain may incur costs as a consequence of the introduction of the eTIR system.

**b. Technological options**

28. The technological options in the CBA allow for a good comparison of the various hosting possibilities of the eTIR international system. Nevertheless, all analysed technological options are based on the development of the eTIR international system from scratch. The use (and configuration) of "off the shelf" solutions has not been considered, neither in the technical evaluation nor in the CBA.

**c. Scenarios**

29. The two scenarios analysed by the consultants are relatively straightforward, due to the fact that they do not take into account any future political or economic developments. Over a period of a decade, many factors may have a significant influence on the annual number of TIR transports. The following, non-exhaustive list, contains an overview of potential events, which may significantly influence the use of the TIR system and, thus, the eTIR international system:

- The ratification and use of the TIR Convention by new countries (e.g. China, Pakistan);
- The extension or creation of other transit agreements as alternatives to the TIR system (e.g. Turkey joining the Common Transit Convention);
- The creation or extension of Customs Unions (e.g. the Russia-Belarus-Kazakhstan Customs Union);
- Variations in trade flows, which could significantly affect international road transport patterns;
- The fluctuation in energy prices, which has direct repercussions on the modal split of international transport.

30. It should be stressed that, although possibly very important, the probabilities as well as the effects of such events occurring (as well as others) remain very difficult to estimate and require dedicated studies. The combined effects are even more difficult to analyse and, thus, it seems understandable that the consultants have not taken them into account in the CBA. However, the two scenarios proposed by the consultants allow comparing two significantly different patterns in the usage of the eTIR international systems and their influence on the profitability of the project.

## **2. Assumptions**

31. The consultants' assumptions are sound and generally based on concrete reference material.<sup>2</sup> However, considering that some of the favoured options envisage that the eTIR international system be hosted in an international data centre in Geneva, the labour costs, calculated as a weighted average of European wages, seem too low.

---

<sup>2</sup> The functionalities of the eTIR system, taken into account by the consultants in the CBA, are those described in version 3.0 of the eTIR Reference Model (ECE/TRANS/WP.30/2011/4). In case Contracting Parties, when preparing for the introduction of a legal framework to enable the eTIR system, decide to introduce requirements which are new to or different from those described in the eTIR Reference Model, the results of the CBA might change or even lose relevance.

### **3. Methodological aspects**

#### **a. Function point analysis**

33. The FPA, used for the estimation of the development costs of the three components of the eTIR international system, allows for a realistic assessment of the complexity of each function to be performed by each component and allows, therefore, a realistic estimation of the development efforts for the whole system.

#### **b. Costs**

34. The consultants have undertaken a very detailed analysis of the costs attributable to the various technological options. They thoroughly listed and priced development, equipment, helpdesk and maintenance costs for a system that can handle 3 million TIR transport per year. On the basis of optimistic and pessimistic assumptions, they have calculated minimum and maximum costs. Yet, to be on the safe side, they considered only maximum costs and have increased them by a 20% risk factor.

35. However, the assumption that total variable costs can be divided by the number of TIR transports in order to calculate unitary costs is questionable. Indeed, this may be a valid assumption for cloud solutions, but it does not take into account that, for some options, the variable costs are not fully scalable (e.g. personnel or infrastructure costs). Furthermore, some costs may be missing or underestimated, in particular those that relate to personnel costs (see III.2), as well as training costs.

#### **c. Benefits**

36. The consultants' estimation of the benefits is purely based on the difference in time required to provide and process electronic information compared to paper, together with the consequences of reducing the processing time for Customs officers and the time spent at Customs offices for transport operators. To be on the safe side, any benefits have been decreased by a 20% risk factor. The consultants did, indeed, take into account that the benefits of a computerized system may not automatically lead to savings in personnel costs and that some benefits are already present today, e.g. the obligation to provide advance information on incoming TIR transports in the EU.

37. Considering that providing advance information to Customs and increasing security are major objectives of the eTIR project, it is unfortunate that the consultants have not even made an attempt to estimate those benefits. Those missing benefits would, most likely, largely offset the costs which remain missing or are underestimated.

#### **d. CBA**

37. The consultants have used a standard cost benefit methodology, calculating the present value of future costs and benefits with a 5% discount rate. The use of both ROI and NPV gives an approximate idea of the profitability and the actual value of the project, taking into account the various technological options. Most importantly, the ROI and NPV allow for an adequate comparison of the technological options for both scenarios.

### **4. Conclusions**

38. The CBA provides, for the various technological options, a good estimation of the profitability of the eTIR project as well as an approximation of the amounts that would be required to develop and maintain it. It shows that the profitability of the project for Customs alone depends significantly on the future usage of the system, but that the overall

ROI remains highly positive, even if the system would only be used for a limited number of TIR transports.

39. Despite the fact that some assumptions of the CBA can be criticized in that they underestimate some costs and benefits, the methodology used remains solid and, therefore, the CBA demonstrates that the eTIR project could be greatly beneficial for all the actors involved in the TIR procedure, in particular transport operators.

#### **IV. Recommendations**

40. On the basis of the results of the CBA and its own expertise, the Expert Group might wish to make the following recommendations to WP.30 as a conclusion of the financial assessment of the eTIR project:

- i. Considering that the eTIR project seems to be highly profitable for all parties involved in the TIR procedure, in particular TIR Carnet holders, it is recommended that the eTIR international system be implemented as soon as possible and that countries start working on the interoperability between their IT systems and the eTIR international system, as well as on the preparation of the required legal provisions;
  - ii. Considering the large benefits for TIR Carnet holders, a potential avenue to explore seems to be the financing of the eTIR international system through a contributory system per TIR transport, similar to the one used for TIRExB.
  - iii. Considering the commercial sensibility of the data that will be handled by the eTIR international system and in view of the relatively small costs differences with the cloud solution recommended in the CBA, it is recommended that the eTIR international system be hosted at UNICC or UNOG data centres;
  - iv. Considering the availability of orchestration software on the market, it is recommended to consider the use of “off the shelf” solutions to implement the kernel of the eTIR international system.
-