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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

Twentieth session
Prague, 19-20 April 2012
Item 5 of the provisional agenda
Financial implications of the introduction of the eTIR international system

Draft cost-benefit analysis (part 2)

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), the TIR Executive Board mandated the secretariat to conduct a cost-benefit analysis 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 in 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. Considering that the cost-benefit analysis has not yet been finalised and consolidated into a single document, the various chapters are presented independently. The draft cost-benefit analysis is reproduced in the annexes of the following informal documents:

Informal document GE.1 No.6a (2012)	System Architecture alternatives
Informal document GE.1 No.6b (2012)	Costs Analysis
Informal document GE.1 No.6c (2012)	Benefits Analysis and Cost-Benefit Analysis
Informal document GE.1 No.6d (2012)	Executive summary and recommendations
Informal document GE.1 No.6e (2012)	Annex : References and applicable documents

II. Disclaimer

3. All parts of the cost-benefit analysis, including but not limited to the various assumptions on which they are based, are the sole responsibility of the authors and do not necessarily reflect the views of the UNECE secretariat. As yet, the UNECE secretariat's contribution to the analysis has been limited to ensuring that the methodologies required for a successful cost-benefit analysis have been properly applied. Considering that the cost-benefit analysis is still under review and may, possibly, be subject to further amendments, the results presented in the annex should be considered as provisional and as merely intended to brief GE.1 on the current state of play with regard to the issue at stake.

III. Further considerations

4. The GE.1 may wish to consider the part of the cost-benefit analysis as contained in the annex, provide comments or suggestions for its improvement as well as, possibly, formulate first and preliminary recommendations with regard to the most appropriate – or most realistic – option to be pursued.

Annex Costs Analysis

United Nations

Economic Commission for Europe

Inland Transport Committee

Project:

Cost Benefit analysis of the eTIR system

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Costs Analysis

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Revisions

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02	21	12/03/2012	Update (New approach for FPA)	Iacob Crucianu	I,U	All
02	31	12/03/2012	Update (check)	Iacob Crucianu	U	All
03	11	14/03/2012	Added costs estimations	Iacob Crucianu	I	3
03	21	16/03/2012	Costs estimations for Help desk	Iacob Crucianu	I	3
03	31	19/03/2012	Cost estimations for National Customs Administrations	Iacob Crucianu	I	3
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09	51	13/04/2012	Change Graphic for SaaS, minor corrections, summary tables	Iacob Crucianu	U	All

(*) Actions: I = Insert, U = Update, D = Delete, M = Merge, C=Comments

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0. DOCUMENT CONTROL

0.1. ISSUE CONTROL

This document has been issued by:

- SIVECO Romania SA,

We will refer to SIVECO Romania SA in the present document by using **SIVECO**.

The current project: the Cost Benefit Analysis of eTIR will be referred to in this document as **eTIR-CBA**

This document is going to be reviewed by UNECE and accepted.

0.2. DISTRIBUTION CONTROL

Copy No.	Name	Project Title	Company
X01	File Copy	Original Master	SIVECO Project Office
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X05	Iacob Crucianu	Team Leader	SIVECO

1. INTRODUCTION

1.1. PROJECT OVERALL OBJECTIVE

The overall objective of the eTIR-CBA project is to analyze, from a technical and financial perspective, the technical options for the implementation of the eTIR system.

The first step in accomplishing this objective is defining the architectural alternatives, which is the subject of document **UNECE-eTIR_CBA-ARCH-v02-31**

The second step is an estimation of the software development costs for the eTIR international system. This is the subject of the present document.

The third step is dedicated to the cost analysis (TCO) for all architectural alternatives. This is also the subject of the present document.

The next steps will be dedicated to the benefits analysis and are subject to subsequent documents.

1.2. SUMMARY OF COSTS ESTIMATIONS

The purpose of the Cost Estimation document is to present:

- The estimated dimension of the system based on a Function Point Analysis;
- The estimated development cost and schedule for developing and implementing the system;
- The costs to support the operations of the system;
- The costs of a technical helpdesk;
- The costs necessary to adapt national Customs IT systems to interface with eTIR;
- The costs for transport operators.

The results of the cost estimation for a 10 year period, for **system setup and daily operations** for the various architecture options and for the two different scenarios ((a) the eTIR system is used for all TIR transport from the beginning and (b) the system is gradually implemented (see table 14)) ,are summarized below.

The estimation error is considered to be less than 5% for over-evaluation and less thanr 20% for under-evaluation.

The costs are based on the system dimension defined for the actual number of TIR operations.

1.2.1. eTIR international system costs, when the eTIR system is used for all TIR transports from the beginning

Option	*Current USD*	
	Min	*Max*
At premises	5,583,990	7,837,590
UNOG	3,553,690	4,352,090
UNICC	3,233,990	4,440,590
IaaS	2,690,816	3,401,265
PaaS	2,707,960	3,178,160
SaaS	15,060,000	30,075,000

Table 1. Development and operational costs, when the eTIR system is used for all TIR transports from the beginning

SaaS: minimum $0.5 per TIR Carnet, maximum $1 per TIR Carnet

This table is a copy of the Table 10 from chapter 3.1

1.2.2. eTIR international system costs, when eTIR is gradually implemented

Option	*Current USD*	
	Min	*Max*
At premises	4,389,800	5,807,000
UNOG	2,796,300	3,224,000
UNICC	2,406,800	3,004,500
IaaS	2,236,800	2,834,500
PaaS	2,136,800	2,364,500
SaaS	8,560,000	17,105,000

Table 2. Development and operational costs, eTIR gradually implemented

SaaS: minimum $0.5 per TIR Carnet, maximum $1 per TIR Carnet

This table is a copy of the Table 10 in chapter 3.1

1.2.3. Helpdesk costs

Considering that the help desk is organized at premises (2 persons, working hours), the total costs for 10 years are:

	Min	***Max***
Initial	$24,500	$44,000
Operational	$181,800	$576,000
Personnel	$1,080,000	$1,590,000
Total	***$1,286,300***	***$2,210,000***

Table 3. Helpdesk costs

This table is a copy of Table 12 in chapter 3.1

For SaaS, the helpdesk is considered to be included in the costs previously presented.

1.2.4. National costs

The costs to adapt national Customs IT systems, for all 68 countries, in order to exchange data with the eTIR international system, are:

	Min	***Max***	***Explanation***
Development	**$7,006,205**	**$8,500,000**	**~13 Man/month * $8000 minimum costs or 25 Man/Month * $5000 maximum costs** **68 countries**

Table 4. Costs to addpt national IT systems

This table is a copy of Table 13 in chapter 3.1

The estimation error is considered to be less than 5% for over-evaluation and less than 20% for under-evaluation.

The costs are based on the system dimensions defined for the actual number of TIR operations.

1.2.6. Total costs (minimum value)

Adding all costs, the following total costs arise:

a. System started for all TIR Carnet transports

Adding values for development, initial and operational costs (Table 1), helpdesk costs (Table 3) and costs to adapt national IT systems (Table 4) we arrive at the following summary of all costs:

Total Dev, Operational;		At Premises	UNOG	UNICC	PAAS	IAAS	SaaS
	Dev.	$924,800	$924,800	$924,800	$924,800	$924,800	$0
	Initial	$1,255,000	$681,500	$632,000	$192,000	$632,000	$60,000
	Operational	$3,404,190	$1,947,390	$1,677,190	$1,591,160	$1,134,020	$15,000,000
Total Dev, Operational;		$5,583,990	$3,553,690	$3,233,990	$2,707,960	$2,690,820	$15,060,000
Help Desk		$1,286,300	$1,286,300	$1,286,300	$1,286,300	$1,286,300	$1,286,300
National App		$7,006,205	$7,006,205	$7,006,205	$7,006,205	$7,006,205	$7,006,205
Total		**$13,876,495**	**$11,846,195**	**$11,526,495**	**$11,000,465**	**$10,983,325**	**$23,352,505**
Total Costs (including 20% risk factor)		**$16,651,794**	**$14,215,434**	**$13,831,794**	**$13,200,558**	**$13,179,990**	**$28,023,006**
Discounted Costs[1]		**$14,830,024**	**$12,904,598**	**$12,610,927**	**$12,044,122**	**$12,131,588**	**$22,646,607**

Table 5. Total costs of eTIR when the eTIR system is used for all TIR transport from the beginning

[1] Discount rate = 5% (applied to total costs including risk factor)

b. System gradually implemented

Total Dev, Operational;		At Premises	UNOG	UNICC	PAAS	IAAS	SaaS
	Develop.	$924,800	$924,800	$924,800	$924,800	$924,800	$0
	Initial	$1,255,000	$681,500	$632,000	$192,000	$632,000	$60,000
	Operational	$2,210,000	$1,190,000	$850,000	$1,020,000	$680,000	$8,500,000
Total Dev, Operational;		$4,389,800	$2,796,300	$2,406,800	$2,136,800	$2,236,800	$8,560,000
Help Desk		$1,286,300	$1,286,300	$1,286,300	$1,286,300	$1,286,300	$1,286,300
National App		$7,006,025	$7,006,025	$7,006,025	$7,006,025	$7,006,025	$7,006,025
Total Costs		**$12,682,125**	**$11,088,625**	**$10,699,125**	**$10,429,125**	**$10,529,125**	**$16,852,325**
Total Costs (including 20% risk factor)		**$15,218,550**	**$13,306,350**	**$12,838,950**	**$12,514,950**	**$12,634,950**	**$20,222,790**
Discounted Costs		**$12,176,220**	**$10,706,503**	**$10,374,647**	**$10,022,078**	**$10,236,332**	**$14,877,363**

Table 6. Total costs, eTIR gradually implemented

The rest of the document is divided into two main parts:

- Estimation of the dimension of the eTIR system, based on FPA and subsequently used to calculate the development costs (Chapter 2);
- Estimation of other costs (Chapter 3).

2. DEVELOPMENT COSTS ESTIMATIONS

2.1. SUMMARY OF DEVELOPMENT COSTS

This chapter presents a detailed estimation of the system dimensions and also estimates the costs and schedules for development. The final conclusion obtained after the whole estimation process, indicates the following costs for development:

	Development	
Impl. Type	***Current USD***	
	Min	***Max***
At premises	924,800	1,127,000
UNOG	924,800	1,127,000
UNICC	924,800	1,127,000
IaaS	924,800	1,127,000
PaaS	924,800	1,127,000
SaaS	0	0

Table 7. Summary of development costs

The costs are not dependent on the software architecture used.

A shorter development duration, employing a highly experienced team is calculated as follows:
Effort = 115.6 Person-months; Unit Cost $8000 man/month
Schedule = 17.6 Months

A longer development duration, employing a medium experienced team is calculated as follows:
Effort = 225.4 Person-months; Unit Cost $5000 man/month
Schedule = 21.9 Months

The above table (Table 7) is computed by summing the costs estimated in current USD, based on FP.

Minimum values (first column) are computed by considering the minimum costs for development indicated in the tables of Chapter 2.1.4 (cost estimations for the development of the full system, employing a highly experienced team).

Maximum values (second column) are computed by considering the maximum costs for development indicated in the tables of Chapter 2.1.3 (cost estimations for the development of the full system, employing a medium experienced team).

We do not consider a risk ratio, as the development will be done in the first years and, in this case, the risk is covered by the buffer between minimum and maximum costs.

2.2. INTRODUCTION

The estimations of the eTIR international system have been performed while taking into account the functional and technical specifications contained in the eTIR Reference Model 3.0.

The estimations were made in several steps:

Step 1: Total Unadjusted Function Points (TUFP) were estimated based on functional and technical specifications from the eTIR Reference Model

Step 2. Adjusted Processing Complexity (APC) was computed based on the system global characteristics as established in the Architecture document – UNECE-eTIR_CBA-ARCH-v02-21.doc

Step 3. Total Adjusted Function Points (TAFP) were calculated by applying APC to TUFP.

Step 4. Schedule and cost estimations were performed by means of applying the COCOMO II methodology, based on TAFP, environment variables.

2.3. ASSUMPTIONS

2.3.1. Assumptions regarding the quantity and type of data to be processed

The assumptions are based on document **ECE/TRANS/WP.30/GE.1/2011/5 [R5]** and are reproduced below:

> On the basis of the functional requirements laid down in Chapter 2 and 3 of the eTIR Reference model[1] and the available statistics on the distribution of TIR Carnets, the meeting formulated a set of preliminary assumptions with regard to the possible technical specifications of the future eTIR international system, as follows:
>
> - The eTIR international system should be able to manage approximately 3 million TIR transports per year;
> - Each TIR transport consists, on average, of 3 TIR operations;

- 1% of guarantees, issued by the guarantee chain, are cancelled each year;
- 50% of all TIR transports give rise to direct queries of the eTIR international system, from both Customs and the guarantee chain;
- 10% of all initially lodged Customs declarations are later amended.

Table 1 presents the assumed number of each message as well as the totals.

Table 1

Estimated number of messages *Various types of eTIR messages*	*No. of messages*
Incoming	
E1 – Register guarantee	3 030 000
E3 – Cancel guarantee	30 000
E5 – Query guarantee	1 515 000
I1 – Accept guarantee	3 000 000
I5 – Query guarantee	1 500 000
I7 – Record Advance Cargo Information	3 300 000
I9 – Start TIR operation	9 000 000
I11 – Terminate TIR operation	9 000 000
I13 – Discharge TIR operation	9 000 000
Total Incoming	**39 375 000**
Outgoing	
I3 – Get holder info	27 375 000
E7 – Notify guarantee chain	33 300 000
I15 – Notify Customs	3 300 000

2.3.2. Assumptions regarding the eTIR international functional components

Three main functional components of the eTIR international system are considered:

1. eTIR international kernel (called also eTIR kernel). This is the main component responsible for the business logic and data exchange, using web services.
2. eTIR international user interface system. This system is used as fallback procedure, to enter data into the system, using a user interface. The business logic used is similar to the one used for the eTIR international kernel.
3. eTIR administration console, which is used in order to:
    a. Manage users, connections, reference data;
    b. Monitor the system;
    c. Audit actions.

The estimations were first performed for each functional component before presenting the aggregated results.

2.4. HOW THE FPA ESTIMATIONS WERE DONE.

In order to apply FPA, the following references have been used:

- Use cases described in the **eTIR Reference Model [R2**], Chapter 2.3 pg. 89-116;
- Activity analysis described in the **eTIR Reference Model [R2]**, Chapter 3.1 pg 117-128;
- Data model described in the eTIR **Reference Model [R2]**, Chapter 3.1 pg 117-128;
- Management by Customs of data on guarantees class diagram in the **eTIR Reference Model [R2]**, Chapter 3.2.1 pg. 136;
- Declaration class diagram in the **eTIR Reference Model [R2]**, Chapter 3.2.2 pg. 137;
- TIR operations class diagram in the **eTIR Reference Model [R2]**, Chapter 3.2.3 pg. 138;

- eTIR declaration mechanism described in the **eTIR Reference Model [R2],** Annex VI, pg. 501-515.
- Data element definitions(the Ix messages and Ex messages) as defined in **the eTIR Reference Model [R2**], Chapter 3.2.5 pg. 141-279.)
- The "GENERAL SYSTEM CHARACTERISTICS" defined in **UNECE-eTIR_CBA-ARCH-v01-61 [R17],** Chapter 3.4 pg. 22-29.

Use cases and sequence diagrams have been used to identify the required functionalities of the eTIR international system. Based on the identified functionalities and data processing involved, we computed the **Total Unadjusted Function Points (TUFP).**

Based on the required technical characteristics, we have computed the **Total Adjusted Function Points (TAFP).**

When computing TUFP, we have used the following elements:

- External Inputs (EI);
- External Outputs (EO);
- External Inquiry (EQ);
- Internal Logical Files (ILF);
- External Interface Files (EIF).

The relationship between these elements is based on the following matrix:

Entity	RETs	FTRs	DETs
EI	Not counted	To be counted	To be counted
EO	Not counted	To be counted	To be counted
EQ	Not Counted	To be counted	To be counted
EIF	To be counted	Not Counted	To be counted
ILF	To be counted	Not Counted	To be counted

When computing TUFP and TAFP, the following definitions have been applied:

External Inputs (EI) – is an elementary process in which data crosses the boundary from outside to inside. This data is external to the application. The data

may come from a data input screen or another application. The data may be used to maintain one or more internal logical files. The data can be either control information or business information. If the data is control information it does not have to maintain an internal logical file.

FTRs and DETs are used to determine EI.

External Outputs (EO) – an elementary process in which derived data passes across the boundary from inside to outside. Additionally, an EO may update an ILF. The data creates reports or output files sent to other applications. These reports and files are created from information contained in one or more internal logical files and external interface files.

FTRs and DETs are used to determine EO.

External Inquiry (EQ) – an elementary process with both input and output components that result in data retrieval from one or more internal logical files and external interface files. The input process does not update or maintain any FTR's (Internal Logical Files or External Interface Files) and the output side does not contain derived data.

FTRs and DETs are used to determine EQ.

Internal Logical Files (ILF) – a user identifiable group of logically related data that resides entirely within the application boundary and is maintained through External Inputs. An internal logical file has the inherent meaning that it is internally maintained, has some logical structure and is stored in a file.

External Interface Files (EIF) – a user identifiable group of logically related data that is used for reference purposes only. The data resides entirely outside the application boundary and is maintained by another application' external inputs. The external interface file is an internal logical file for another application. An application may count a file as either an EIF or ILF, but not both. An external interface file has the inherent meaning that it is externally maintained (probably by some other application), that an interface has to be developed to get the data and that it is stored in a file.

Record Element Type (RET): A RET is a user recognizable subgroup of data elements within an ILF or an EIF. It is best to look at logical groupings of data to help identify them.

Message				
Guarantee	1	..	1	R
Error	0	..	unbounded	D
Pointer	1	..	unbounded	R

c. Classes and attributes (English Only)

Message				
Type, coded				
Message reference number				
Message function, coded				
Functional reference				
GUARANTEE	**Occurrence**	**1**	**..**	**1**
Reference				
ERROR	**Occurrence**	**0**	**..**	**unbounded**
Error, coded				
POINTER	**Occurrence**	**1**	**..**	**unbounded**
Sequence number				
Document/message section, coded				
Tag identifier				

Fig 1. Definition of eTIR message

File Type Referenced (FTR): A FTR is a file type referenced by a transaction. An FTR must also be an internal logical file or an external interface file.

Data Element Type (DET): A DET is a unique user recognizable, non-recursive (non-repetitive) field. A DET is information that is dynamic and not static. A dynamic field is read from a file or created from DETs contained in a FTR. Additionally, a DET can invoke transactions or can be additional information regarding transactions.

2.5. FPA ESTIMATION RESULTS

The final results, after applying the FPA methodology, are presented below.

The detailed estimation is presented in ANNEX I, UNECE-eTIR_CBA-EST-ANNEX-I-FPA-V02-21

We present first a separated estimation for each functional module, then a consolidated estimation.

2.5.1. Assumptions, limitations

- All answer messages (I2, I4,.. I14, E2, E4,..E10) were considered as just answers given by the system, without persistence in the system and consequently not counted as EO or ILF, but just as a RET for an EI or an EQ;
- Error messages were not counted as EO (just RET for EI);
- The workflow is considered fixed and hardcoded. No changes in the workflow of messages are possible without changing the software;
- There is no separate history of actions. All messages are stored, but no separate history mechanism is considered;
- No follow-up of messages is possible, apart from the answer if a messages was received or not;
- There is no browsing mechanism for messages. If such a mechanism is necessary, new external enquiries should be defined;
- No risk analysis checks have been considered. If the checking of risky transactions is necessary, then new external enquiries should be defined;
- No printing mechanism exists for eTIR data;
- No export of data in other formats than the XML native format;
- No queue mechanism is considered.

2.5.2. Estimation results for the eTIR international kernel

Function Point Estimation Worksheet							
Description	Complexity						
	Low		Medium		High		Total
EI	1	x 3	2	x 4	7	x 6	53
EO	0	x 4	1	x 5	1	x 7	12
EQ	1	x 3		x 4	1	x 6	9
ILF	42	x 7	2	x 10	0	x 15	314
EIF	1	x 5	0	x 7	0	x 10	5
					Total Unadjusted Function Points (TUFP):		**393**

2.5.3. Estimation results for the eTIR user interface

Function Point Estimation Worksheet							
	Complexity						
Description	Low		Medium		High		Total
EI	1	x 3	2	x 4	7	x 6	53
EO	0	x 4	1	x 5	1	x 7	12
EQ	1	x 3	10	x 4	1	x 6	49
ILF	42	x 7	2	x 10	0	x 15	314

EIF	1	x 5	0	x 7	0	x 10	5	
		Total Unadjusted Function Points (TUFP):					**433**	

2.5.4. Estimation results for the eTIR administration console

Function Point Estimation – eTIR administration console							
	Complexity						
Description	Low		Medium		High		Total
EI	6	x 3	1	x 4	2	x 6	34
EO	8	x 4	1	x 5	0	x 7	37
EQ	1	x 3	6	x 4	0	x 6	27
ILF	8	x 7	0	x 10	0	x 15	56
EIF	6	x 5	1	x 7	0	x 10	37
		Total Unadjusted Function Points (TUFP):					191

2.5.5. Estimation results for the full eTIR international system

No	Component	TUFP
1	eTIR international kernel	393
2	eTIR user interface	433
3	eTIR administration console	191
	Total	***1017***

2.5.6. General system characteristics which influence the estimations

The general characteristics of the system have been used to compute the Total Adjusted Function Points, which finally were the input of the cost and schedule estimation.

GENERAL SYSTEM CHARACTERISTICS		Effect (0-5)
Centralized approach		5
Service Oriented Architecture		4
System Performance		5
Heavily Used Configuration, availability		5
Transaction frequencies, scalability		5
Online data entry		5
User-friendly interface, documentation quality		4
Online updates		4
Complexity of processing		4
Reusability of data (non-redundancy)		3
Easy to be installed and configured		4
Integration with third party applications, especially report tools		4
Configurable at runtime, facilitates change		5
Reliability and stability		5

Table 8. General system characteristics

(0=no effect on processing complexity;

5=great effect on processing complexity)

Process complexity: 62

Adjusted Processing Complexity (PCA) =

1.27

2.5.7. Total Adjusted Function Points (TAFP):

No	Component	TUFP	TAFP
1	eTIR international kernel	393	500
2	eTIR user interface	433	550
3	eTIR administration console	191	243
	Total	***1017***	***1293***

Table 9. Total adjusted FP

2.5.8. Final remarks on FPA estimation

The estimation considers developing the system from scratch. For this reason, some effort could be smaller due to the existence of the eTIR Reference Model, which contains parts of the analysis and design phases.

By using analogy with other customs system, for which detailed data on project costs and schedule was available, the current FPA estimation indicates that:

- The overestimation risk is very low (<5%);
- The underestimation risk is acceptable (<20%).

2.1. SCHEDULE AND COST ESTIMATION

2.1.1. Introduction

Based on the estimated Function Points (described in the previous chapter), the COCOMO II methodology [2][8] has been applied to estimate the schedule and the costs for the development of the eTIR international system.

It should be noted that the estimations only apply to the development and implementation.

The following costs are NOT included:

> Training, maintenance, technical support, consultancy on legal aspects, helpdesk, changes (if any) in national Customs IT systems, changes (if any) in trader IT systems, changes (if any) for ITDB, changes (if any) requested by guarantee chain systems.

There are two variants (options):

- The first variant is based on a medium qualified and experienced team;
- The second variant is based on the assumption that the eTIR international system is developed and implemented by a highly qualified and experienced team.

2.1.2. Assumptions

The assumptions used when computing the schedule and cost estimates are those presented in the table below:

For a medium qualified team we assume that:

Development style	
Precedence	Medium
Development Flexibility	Medium
Software Cost Drivers	
Required Software Reliability	Medium

Data Base Size	Medium
Product Complexity	Medium
Developed for Reusability	Medium
Documentation Match to Lifecycle Needs	Medium
Architecture / Risk Resolution	Medium
Personnel	
Team Cohesion	Medium
Analyst Capability	Medium
Programmer Capability	Medium
Personnel Continuity	Medium
Application Experience	Medium
Platform Experience	Medium
Language and Toolset Experience	Medium
Process Maturity	**Medium**
Platform	
Time Constraint	Medium
Storage Constraint	Medium
Platform Volatility	Medium
Project	
Use of Software Tools	Medium
Multisite Development	Medium
Required Development Schedule	Medium

Cost per Person-Month (Dollars): $5,000

For a highly experienced team we assume that:

Development style	
Precedence	Medium
Development Flexibility	Medium
Software Cost Drivers	
Required Software Reliability	High
Data Base Size	Medium
Product Complexity	High
Developed for Reusability	Medium
Documentation Match to Lifecycle Needs	High
Architecture / Risk Resolution	High
Personnel	
Team Cohesion	High
Analyst Capability	High
Programmer Capability	High
Personnel Continuity	Very High
Application Experience	Very High
Platform Experience	High
Language and Toolset Experience	High
Process Maturity	**High**
Platform	
Time Constraint	Medium

Storage Constraint	Medium
Platform Volatility	Medium
Project	
Use of Software Tools	High
Multisite Development	Medium
Required Development Schedule	Medium

Cost per Person-Month (Dollars): $8,000

2.1.3. Cost and schedule for the full system when a medium experienced development team is employed

Software Engineering

Effort = 225.4 Person-months
Schedule = 21.9 Months
Cost = $1,127,000

Total Equivalent Size =51720

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	9.4	2.7	4.9	$47,000
Elaboration	47	8.2	6.6	$235,000
Construction	147	13.7	12.5	$735,000
Transition	22	2.7	9.9	$110,000
Total	225.4			$1,127,000

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Tot
Management	1	5.5	15	3	24.5
Environment/CM	0.8	4.3	8	1	14.1
Requirements	3	7.7	11	1	22.7
Design	2.2	16.5	22	1	41.7
Implementation	1	6	45	4	56
Assessment	1	5.4	41	5	52.4
Deployment	0.4	1.6	5	7	14
Total	9.4	47	147	22	

2.1.4. Cost and schedule for the full system when a highly experienced development team is employed

Software Engineering

Effort = 115.6 Person-months
Schedule = 17.6 Months
Cost = $924,800

Total Equivalent Size =51720

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	5.6	2.2	3.2	$44,800
Elaboration	24	6.6	4.2	$192,000
Construction	75	11	8	$600,000
Transition	11	2.2	6.3	$88,000
Total	115.6			$924,800

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Total
Management	1	3	5	1	10
Environment/CM	0.5	2	3	0.5	6
Requirements	2	4	7	0.5	13.5
Design	1	8	14	0.5	23.5
Implementation	0.5	3.5	24	2.5	30.5
Assessment	0.4	2.5	20	3	25.9
Deployment	0.2	1	2	3	6.2
Total	5.6	24	75	11	

2.1.5. Cost and schedule for the eTIR international kernel when a medium experienced team is employed

Software Engineering

Effort = 71.3 Person-months
Schedule = 15.0 Months
Cost = $356,500

Total Equivalent Size =20000

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	3	1.9	2.3	$15,000
Elaboration	14	5.6	3	$70,000
Construction	48	9.4	5.8	$240,000
Transition	6.3	1.9	4.6	$31,500
Total	71.3			$356,500

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Total
Management	0.5	1.5	4	1	7
Environment/CM	0.2	1	2.5	0.2	3.9
Requirements	1.2	3	4	0.2	8.4
Design	0.5	5	8	0.3	13.8
Implementation	0.3	1.5	16	1.1	18.9
Assessment	0.2	1.5	12	2	15.7
Deployment	0.1	0.5	1.5	1.5	3.6
Total	3	14	48	6.3	

2.1.6. Cost and schedule for the eTIR international kernel when a highly experienced team is employed

Software Engineering

Effort = 41.2 Person-months
Schedule = 12.5 Months
Cost = $329,600

Total Equivalent Size =20000

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	2	1.6	1.6	$16,000
Elaboration	8.2	4.7	2.1	$65,600
Construction	27	7.8	4	$216,000
Transition	4	1.6	3.2	$32,000
Total	41.2			$329,600

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Total
Management	0.1	1	2	0.2	3.3
Environment/CM	0.2	0.5	1.5	0.2	2.4
Requirements	0.7	1.5	2	0.2	4.4
Design	0.5	3	4	0.2	7.7
Implementation	0.2	1	10	0.7	11.9
Assessment	0.2	1	7	1	9.2
Deployment	0.1	0.2	0.5	1.5	2.3
Total	2	8.2	27	4	

2.1.7. Cost and schedule for the eTIR kernel and administration when a medium experienced development team is employed

Software Engineering

Effort = 122.5 Person-months
Schedule = 17.9 Months
Cost = $612,500

Total Equivalent Size =29720

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	7.5	2.2	3.3	$37,500
Elaboration	23	6.7	4.4	$115,000
Construction	80	11.2	8.3	$400,000
Transition	12	2.2	6.6	$60,000
Total	122.5			$612,500

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Total
Management	1	2	7	1.5	11.5
Environment/CM	0.7	2	4	0.5	7.2
Requirements	3	4	8	0.5	15.5
Design	1.4	9	12	0.5	22.9
Implementation	0.6	3	25	3	31.6
Assessment	0.6	2	21	2	25.6
Deployment	0.2	1	3	4	8.2
Total	7.5	23	80	12	

2.1.8. Cost and schedule for the eTIR kernel and administration when a highly experienced development team is employed

Software Engineering

Effort = 60.7 Person-months
Schedule = 14.2 Months
Cost = $485,600

Total Equivalent Size =29720

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	3	1.8	2	$24,000
Elaboration	11	5.3	2.7	$88,000
Construction	40	8.9	5.2	$320,000
Transition	6.7	1.8	4.1	$53,600
Total	60.7			$485,600

Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition	Total
Management	0.2	1	3	0.5	4.7
Environment/CM	0.4	1	1	0.4	2.8
Requirements	1.2	2	3	0.3	6.5
Design	0.6	4	7	0.3	11.9
Implementation	0.3	1.6	14	1.4	17.3
Assessment	0.2	1	11	1.6	13.8
Deployment	0.1	0.4	1	2.2	3.7
Total	3	11	40	6.7	

2.2. CONCLUSION

For the eTIR international system, composed of three functional components (eTIR kernel, eTIR user interface and the eTIR administration console), the cost estimations are as follows:

- Development costs are between $924,800 and $1 127 000, depending on the qualifications of the development team and assuming a European level of resource costs;.
- Development time varies from 17 to 22 months, depending on the qualifications of the development team;
- The development team can be reasonably small (maximum 9 persons for the highly experienced team and maximum 16 persons for the medium experienced team).

For the eTIR international kernel and administration console

- Development costs are between $485 000 and $ 613 000, depending on the qualifications of the development team and assuming a European level of resource costs;
- Development time to varies from 15 to 18 months depending on the qualifications of the development team;
- The development team can be reasonably small (maximum 6 persons for the highly experienced team and maximum 9 persons for the medium experienced team).

For the eTIR international kernel:

- Development costs are between $330 000 and $ 357 000, depending on the qualifications of the development team and assuming a European level of resource costs;
- Development time varies from 13 to 16 months depending on the qualificatiosn of the development team;

- The development team can be reasonably small (maximum 6 persons for the highly experienced team and maximum 8 persons for the medium experienced team).

3. COST ESTIMATIONS

3.1. SUMMARY OF COST ESTIMATIONS

In this chapter we estimate the costs for the development and operation of the eTIR international system.

The following costs are considered:

- Development of the eTIR solution (see Chapter 2 and 3.4);
- Initial costs (see Chapter 3.5);
- Operation costs (maintenance, daily operations, etc) (see Chapter 3.6);
- Cloud usage costs (see Chapter 3.7);
- Helpdesk cost (see Chapter 3.8);
- National Customs IT system interface developments (see Chapter 3.9);
- Costs for transport operators.

The results indicate the following total costs for a period of 10 years (help desk not included) when eTIR is used for all TIR transports from the beginning:

Type	***Current USD***	
	Min	***Max***
At premises	5,583,990	7,837,590
UNOG	3,553,690	4,352,090
UNICC	3,233,990	4,440,590
IaaS	2,690,816	3,401,265

PaaS	2,707,960	3,178,160
SaaS	15,060,000	30,075,000

Table 10. Summary of costs estimation for development and operation, eTIR is used for all TIR transports from the beginning

The table above is computed by adding the development, initial and all operational costs for 10 years. Details can be found in Table 37, Chapter 3.11.1

Costs when the eTIR system is gradually implemented

Type	***Current USD***	
	Min	***Max***
At premises	4,389,800	5,807,000
UNOG	2,796,300	3,224,000
UNICC	2,406,800	3,004,500
IaaS	2,236,800	2,834,500
PaaS	2,136,800	2,364,500
SaaS	8,560,000	17,105,000

Table 11. Summary of costs estimation for development and operation, eTIR gradually implemented

The table above is computed by adding the development, initial and all operational costs per 10 years. Details can be found in Table 38, Chapter 3.11.2

With regard to the helpdesk, only a technical helpdesk for national Customs IT connections, during working hours, is considered. To helpdesks we do not apply a risk ratio. The minimum and maximum costs cover the application of these factors.

Help desks are considered to be the same (same organization, same costs) for all options and scenarios.

Help desk costs estimated for 10 years:

	Min	Max
Initial	$24,500	$44,000
Operational	$181,800	$576,000
Personnel	$1,080,000	$1,590,000
Total	**$1,286,300**	**$2,210,000**

Table 12. Help desk costs

This is a copy of Table 33 from Chapter 3.8.4

The costs to develop interfaces to national Customs IT systems are (current USD):

	Min	***Max***	***Explanation***
Development	**$5,440,000**	**$6,800,000**	**10 Man/month * $8000 minimum costs or 20 Man/Month * $5000 maximum costs** **68 countries**

Table 13. Costs to adapt national Customs IT systems

The next chapter provides a detailed presentation of the costs mentioned.
At the end, a distribution of costs for development and operation is added. In this distribution of costs, helpdesk costs and national Customs systems interfaces are not included, as they are the same for all implementations and are equally distributed.

3.2. INTRODUCTION

The cost estimations are made for the following architectural alternatives:

- System at premises;
- System hosted at UNOG;
- System hosted at UNICC;
- IaaS;
- PaaS;
- SaaS.

For the estimations of the costs for setup and daily operations, we consider three types of costs:

- Software development and deployment costs;
- Initial infrastructure costs;
- Annual maintenance and operational costs for the next 10 years.

The software development costs are considered identical for each architectural alternative (except for the SaaS option, since the software development would be undertaken by the cloud provider).
The helpdesk is foreseen only for assisting Customs administrations to connect their national Customs IT systems to the eTIR international system (2 persons during working hours).

Estimation of costs for changing national Customs IT system to be interfaced with the eTIR system are computed on the assumption that each country will implement the system from scratch, and independently, the interface.

The estimation of costs for the Trader community reveals that there are no important costs to be considered.

3.3. ASSUMPTIONS

The profile for the application being analyzed of the Windows Azure Platform is as follows:

- Application type: Business Management – Other Business Management Application;
- Development of this application / service: new development;
- Size of this application / service by the hardware and software components used: Large (>10 servers/VMs);
- Best measure of the integration between this application and other applications, either at premises or in the cloud: highly integrated (>10 connections to ITDB and national Customs IT Systems);
- Best measure of user logins supported by the Business Management Application: Heavy user logins (A high number of login connections has to be considered, as each transaction request an login)
- Profile of this application / service over time: Steady Growth – Consistent application usage growth over an extended period of time

Based on the profile of the eTIR application and the type and quantity of data to be processed and exchanged, the system instances are specified as follows:

- Number of instances:
  - Windows Azure instances: 30 (distributed Azure with many instances);
  - Google: 16 (8 back end, 8 front end);
  - Amazon: 16;
  - At Premises: 16 (8 back end, 8 front end);
  - UNOG: 16 (8 backend, 8 front end);
- Average use hours per day: 24.0;

- Average use days per year: 365;
- Storage per year for 3 million eTIR Carnets: 1600GB;
- Transactions (millions) per year for 3 million eTIR Carnets: 150 million;
- Bandwidth IN per year for 3 million eTIR Carnets: 450GB;
- Bandwidth OUT per year for 3 million eTIR Carnets 650GB.

Average values are used to define the system requirements, if the system will start with all TIR Carnets registered. The average values are those considered until now and do not take into account an increased number of registered TIR Carnets.

System workload, based on the assumptions presented in Chapter 2.3:

Characteristics/ Year	1	2	3	4	5	6	7	8	9	10
Number of eTIR Carnets (thousands)	100	700	800	1200	1300	2000	2500	2600	2800	3000
Storage (GB)	600	700	800	900	1000	1200	1300	1400	1500	1600
Bandwidth IN (GB)	200	250	300	350	400	410	420	430	440	450
Bandwidth OUT (GB)	300	350	400	450	500	600	610	620	630	650
Transactions (Millions)	50	60	70	80	100	110	120	130	140	150

Table 14. Estimated eTIR system workload

Unit prices used are established considering:

- Price of working forces is based on a medium EU workforce price in 2011, published in EU statistics (between $3000 and $8000 per month, depending on personnel qualifications);
- Price for training: 1000 per day/trainee;
- Price of electricity: $0.3 as medium price in the EU;
- Price of storage: $0.1 per G, as results from a medium price of hard disks (list prices);
- Future scalability is linked to an increase of eTIR usage with about 10% per year;
- Assurance: 0.1-0.4% for hardware and infrastructure, according to figures provided by representative insurance companies.

3.4. COSTS FOR DEVELOPMENT AND IMPLEMENTATION OF THE ETIR SOLUTION

The costs for developing the eTIR solution are considered the same for each alternative. According to the estimations made previously (see Chapter 2) we have the following figures:

Implementation Type	*Min*	*Max*
At Premises	$924,800	$1,127,000
UNOG	$924,800	$1,127,000
UNICC	$924,800	$1,127,000
IaaS	$924,800	$1,127,000
PaaS	$924,800	$1,127,000
SaaS	-	-

Table 15. Total development costs

Minimum values (first column) are computed by considering the minimum costs for development indicated in the tables of Chapter 2.1.4 (cost estimations for the development of the full system, employing a highly experienced team).

Maximum values (second column) are computed by considering the maximum costs for development indicated in the tables of Chapter 2.1.3 (cost estimations for the development of the full system, employing a medium experienced team).

3.5. INITIAL COSTS

We present here the costs in current USD. Initial costs, at premises implementation

Cost Type	**On Premises**		
	Min	***Max***	***Comments***
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)	30000	40000	3-4 month, 2 persons
Facilities (HVAC, Power, Space)	190000	200000	As presented in R[5]-ECE/ /TRANS/WP.30/GE.1/2010/05
Hardware(Computers, Networks, Storage)	430000	500000	As presented in R[5]-
Software (OS, Database Servers, Core Connectivity)	370000	400000	As presented in R[5]-
Integration Middleware	120000	160000	As presented in R[5]-
Technology training (200-250 days/person)	100000	125000	200-250 days/person X 500$
Personnel recruitment	5000	10000	5-10 Persons X 1000$
Total	**$1,255,000**	**$1,450,000**	

Table 16. Initial costs, at premises implementation

3.5.1. Initial costs when implementing eTIR at UNOG premises

Cost Type	**Premises**		
	Min	Max	Comments
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)	30000	40000	3-4 month, 2 persons
Facilities (HVAC, Power, Space)			No initial costs
Hardware(Computers, Networks, Storage)	49500	49500	Initial supplementary storage and setup costs
Software (OS, Database Servers, Core Connectivity)	370000	400000	As presented in R[5]-
Integration Middleware	120000	160000	As presented in R[5]-
Technology training (100-125 days/person)	100000	125000	100-120 days/person X 500$ - administrators of eTIR
Personnel recruitment	2000	3000	2-3 Persons X 1000$
Total	**$681,500**	**$792,500**	

Table 17. Initial costs UNOG implementation

3.5.1. Initial costs when implementing eTIR at UNICC premises

	Initial Costs, UNICC		
	Min	Max	Comments
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)	30000	40000	3-4 month, 2 persons
Facilities (HVAC, Power, Space)			No initial costs
Hardware(Computers, Networks, Storage)			No initial costs
Software (OS, Database Servers, Core Connectivity)	370000	400000	As presented in R[5]-
Integration Middleware	120000	160000	As presented in R[5]-
Technology training (100-125 days/person)	100000	125000	100-120 days/person X 500$ - administrators of eTIR
Personnel recruitment	2000	3000	2-3 Persons X 1000$
Total	**$632,000**	**$743,000**	

Table 18. Initial costs UNICC implementation

3.5.2. Initial costs when implementing in IaaS

Initial Costs, IaaS

Cost Type	IaaS		
	Min	Max	Comments
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)	30000	40000	3-4 month, 2 persons
Facilities (HVAC, Power, Space)			No initial costs
Hardware(Computers, Networks, Storage)			No initial costs
Software (OS, Database Servers, Core Connectivity)	370000	400000	As presented in R[5]-
Integration Middleware	120000	160000	As presented in R[5]-
Technology training (100-125 days/person)	100000	125000	100-120 days/person X 500$ - administrators of eTIR
Personnel recruitment	2000	3000	2-3 Persons X 1000$
Total	**$632,000**	**$743,000**	

Table 19. Initial costs IAAS

3.5.3. Initial costs when implementing in PaaS

Initial Costs, PaaS

Cost Type	PAAS		
	Min	Max	Comments
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)	30000	40000	3-4 month, 2 persons
Facilities (HVAC, Power, Space)			No initial costs
Hardware(Computers, Networks, Storage)			No initial costs
Software (OS, Database Servers, Core Connectivity)			No initial costs
Integration Middleware			No initial costs
Technology training (100-125 days/person)	100000	125000	100-120 days/person X 500$ - administrators of eTIR
Migration expenses (50-60 man/days)	50000	60000	50-60 man/days X 500$ (Migration of software from local test environment to Cloud, and test)
Personnel recruitment	2000	3000	2-3 Persons X 1000$
Total	**$192,000**	**$243,000**	

Table 20. Initial costs PAAS implementation

3.5.4. Initial costs when implementing SaaS

Cost Type	SaaS		
	Min	***Max***	***Comments***
Purchasing research	10000	15000	2 month, 1-1.5 persons
Setup, Organization (eTIR system)			No initial costs
Facilities (HVAC, Power, Space)			No initial costs
Hardware(Computers, Networks, Storage)			No initial costs
Software (OS, Database Servers, Core Connectivity)			No initial costs
Integration Middleware			No initial costs
eTIR International development and implementation			No initial costs
Technology training (100-125 days/person)			No initial costs

Personnel recruitment			No initial costs
Total	**$10,000**	**$15,000**	

Table 21. Initial Costs SaaS implementation

3.5.5. Initial costs, Summary (current USD)

Initial Total	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	**$192,000**	**$243,000**
SaaS	**$10,000**	**$15,000**

Table 22. Initial Costs, Summary

3.6. COSTS OF OPERATIONS PER YEAR

We consider here the usage of the system in the first year, in the situation where all TIR Carnets are registered in the system. The evolution of costs per year depending on the number of TIR Carnets registered in the system will be presented later.

We present here the costs in current USD. Operations costs per year, at premises

At Premises			
	Minimum	***Maximum***	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)	$7,200	$9,600	240 days, 30-40 $ per hour, one hour per day
Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3	$11,680	$14,600	96-120 Kw/Day*$0.3 or 4-5 Kw per hour
Internet access	$20,000	$30,000	64 M
Testing costs for new releases.	$10,000	$20,000	Two new releases per year, each one tested 5-10 days by two persons
Backup and recovery process(space and processing time)	$12,739	$13,259	Medium space 1000 G for all data, Medium processing time 2 hours, price per space=0.1$ price per processing hour=0.3$. Backup incremental weekly (10-20G x 52 weeks), monthly full (1000G x 12 month).
Disaster recovery costs (external storage space)	$300	$600	1000-2000G per year, 0.3$ per G storage
Technology training for SE and DBA	$8,000	$20,000	Training for SE and DBA (4-6 persons trained, 5 days training each)
System operations Audit (internal and external)-	$10,000	$15,000	Internal audit 2*5 days * 500$.- External audit 1*5 days X 1000$ - 2*5 days X 1000$
Security audit	$4,000	$6,000	Internal audit 2*2 days * 500$.- External audit 1*2 days X 1000$ - 2*2 days X

			1000$
Insurance 0.1% from hardware (100000)	$5,000	$20,000	0.1%-0.4% from hardware (500000$)
Information technology personnel (Only for general operations not related to business process)	$180,000	$300,000	minimum 3 SE (24 hours), Maximum 3 SE, 2DBA X 5000$ a month
Corporate management time (50 days)	$50,000	$52,000	50-52 Days * 1000 $
Long term expenses			
Replacement (5% from hardware per year)	$21,500	$25,000	
Total	***$340,419***	***$526,059***	

Table 23. Costs of operations,at premises implementation

3.6.1. Operations costs per year, UNOG implementation

UNOG			
	Min	***Max***	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)			No costs
Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3			No costs
Testing costs for new releases.	$10,000	$20,000	Two new releases per year, each one tested 5-10 days by two persons
Backup and recovery process(space and processing time)	$12,739	$13,259	Medium space 1000 G for all data, Medium processing time 2 hours, price per space=0.1$ price per processing hour=0.3$. Backup incremental weekly (10-20G x 52 weeks), monthly full (1000G x 12 month).
Disaster recovery costs (external storage space)			No costs
Technology training for SE and DBA	$8,000	$12,000	Training for SE and DBA (4-6 persons trained, 5 days training each)
System operations Audit (internal and external)-			No costs

Security audit	$4,000	$6,000	Internal audit 2*2 days * 500$.- External audit 1*2 days X 1000$ - 2*2 days X 1000$
Insurance 0.1% from hardware (100000)			No costs
Information technology personnel (Only for general operations not related to business process)			No costs
Corporate management time (50 days)	$50,000	$52,000	50-52 Days * 1000 $
Long term expenses			
Replacement (5% from hardware per year)			
Total	***$84,739***	***$103,259***	

Table 24. Costs of operations,UNOG implementation

3.6.1. Operations costs per year, UNICC implementation

UNICC			
	Min	***Max***	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)			No costs
Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3			No costs
Testing costs for new releases.	$10,000	$20,000	Two new releases per year, each one tested 5-10 days by two persons
Backup and recovery process(space and processing time)	$12,739	$13,259	Medium space 1000 G for all data, Medium processing time 2 hours, price per space=0.1$ price per processing hour=0.3$. Backup incremental weekly (10-20G x 52 weeks), monthly full (1000G x 12 month).
Disaster recovery costs (external storage space)			No costs
Technology training for SE and DBA	$8,000	$12,000	Training for SE and DBA (4-6 persons trained, 5 days training each)

System operations Audit (internal and external)-			No costs
Security audit	$4,000	$6,000	Internal audit 2*2 days * 500$.- External audit 1*2 days X 1000$ - 2*2 days X 1000$
Insurance 0.1% from hardware (100000)			No costs
Information technology personnel (Only for general operations not related to business process)			No costs
Corporate management time (50 days)	$50,000	$52,000	50-52 Days * 1000 $
Long term expenses			
Replacement (5% from hardware per year)			
Total	***$84,739***	***$103,259***	

Table 25. Costs of operations, UNICC implementation

3.6.1. Operations costs per year, IaaS implementation

IaaS			
	Min	***Max***	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)			No costs
Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3			No costs
Testing costs for new releases.	10000	20000	Two new releases per year, each one tested 5-10 days by two persons
Backup and recovery process(space and processing time)	12739	13259	Medium space 1000 G for all data, Medium processing time 2 hours, price per space=0.1$ price per processing hour=0.3$. Backup incremental weekly (10-20G x 52 weeks), monthly full (1000G x 12 month).
Disaster recovery costs (external storage space)			No costs
Technology training for SE and DBA	8000	12000	Training for SE and DBA (4-6 persons trained, 5 days training each)

System operations Audit (internal and external)-			No costs
Security audit	4000	6000	Internal audit 2*2 days * 500$.- External audit 1*2 days X 1000$ - 2*2 days X 1000$
Insurance 0.1% from hardware (100000)			No costs
Information technology personnel (Only for general operations not related to business process)			No costs
Corporate management time (50 days)	50000	52000	50-52 Days * 1000 $
Long term expenses			
Replacement (5% from hardware per year)			
Total	***$84,739***	***$103,259***	

Table 26. Costs of operations, IAAS implementation

3.6.1. Operations costs per year, PaaS implementation

PaaS			
	Min	Max	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)			No costs
Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3			No costs
Testing costs for new releases.	10000	20000	Two new releases per year, each one tested 5-10 days by two persons
Backup and recovery process(space and processing time)			Medium space 1000 G for all data, Medium processing time 2 hours, price per space=0.1$ price per processing hour=0.3$. Backup incremental weekly (10-20G x 52 weeks), monthly full (1000G x 12 month).
Disaster recovery costs (external storage space)			No costs
Technology training for SE and DBA			Training for SE and DBA (4-6 persons trained, 5 days training each)

System operations Audit (internal and external)-			No costs
Security audit	4000	6000	Internal audit 2*2 days * 500$.- External audit 1*2 days X 1000$ - 2*2 days X 1000$
Insurance 0.1% from hardware (100000)			No costs
Information technology personnel (Only for general operations not related to business process)			No costs
Corporate management time (50 days)	50000	52000	50-52 Days * 1000 $
Migration			
Long term expenses			
Replacement (5% from hardware per year)			
Total	***$64,000***	***$78,000***	

Table 27. Costs of operations, PAAS implementation

3.6.2. Operations Costs per year, Summary (current USD)

This table summarizes the tables from Table 23, Chapter 0 to Table 27, Chapter 3.6.1. Each line in the table is the last (Total line) in the mentioned tables. The values represent current USD.

Implementation	***Min***	***Max***
At Premises	$340,419	$526,059
UNOG	$84,739	$103,259
UNICC	$84,739	$103,259
IaaS	$84,739	$103,259
PaaS	$64,000	$78,000
SaaS	$0	$0

Table 28. Total operations costs, all implementations

3.7. CLOUDS AND HOSTING COSTS

Variable costs, for a full system workload, are computed for the following providers and types:

1. Microsoft PaaS on Azure platform;
2. Google PaaS on Google App Engine platform;
3. Amazon IaaS;
4. UNOG (IaaS type);
5. UNICC (IaaS type);
6. SaaS.

The price model is very different for each of the mentioned providers. However, what is important at this stage are the total costs of such service per year.

For all providers, the costs of services were computed considering a system workload as presented in Chapter 3.3.

It is considered that this is the first year of functioning, having all eTIR Carnets registered in the system.

Solution	***Current USD***
Microsoft (PaaS):	$102,816 / year
Google (PaaS)	$95,116 / year
UNOG	$110,000 / year
UNICC	$82,980-$118,400 / year
Amazon IaaS	$28,663-$49,867 / year
SaaS	$0.5 - $1 / TIR Transport

Table 29. Cloud Costs

The detailed prices for the mentioned providers are attached in Annex II

3.8. HELPDESK COSTS

A help desk is foreseen for both business and technical related assistance for connections with national Customs IT systems.
The helpdesk is functioning during normal working hours (8 hours a day, 2 system engineers).

With regard to the helpdesk we consider three categories of costs:

- Initial costs;
- Operation costs per year (personnel costs not included);
- Personnel costs.

3.8.1. Initial costs

Cost Type	**Help Desk**		
	Min	***Max***	***Comments***
Setup, Organization (eTIR system)	$5,000	$6,000	1 month, 1 person
Hardware(Computers, Networks, Storage)	$5,000	$10,000	2 servers, 3 desktop computers, phone lines and equipment,
Software (OS, Database Servers, Core Connectivity)	$5,000	$10,000	OS, Database, Helpdesk Software
Technology training (200-250 days/person)	$7,500	$15,000	15-30 days/person X 500$ (3 persons trained)
Personnel recruitment	$2,000	$3,000	2-3 Persons X 1000$
Total	**$24,500**	**$44,000**	

Table 30. Helpdesk detailed costs

3.8.2. Operation costs per year

Help desk			
	Min	Max	***Explanations***
Operation expenses			
Infrastructure (floor space maintenance) (man/days)	$15,000	$30,000	50 square meters office

Electricity (for related equipment, cooling, backup power)120 Kw/Day*$0.3	$11,680	$14,600	96-120 Kw/Day*$0.3 (4-5 Kw per hour)
Phone and internet lines	$6,000	$12,000	Corporate subscription 1000-2000 per month
Other expenses (spared parts)	$500	$1000	paper, CD, replacement of equipment (10% of hardware)
Total	**18,180**	**57,600**	

Table 31. Help Desk costs per year

3.8.3. Personnel costs per year

Personnel costs			
	Min	Max	***Explanations***
Help desk level 1			
Help desk level 1 personnel	$96,000	$144,000	2-3 operators * 4000 per month * 12 month
Managers	$12,000	$15,000	1 manager 1 day per week, 5000-6000 per month
Total	***$108,000***	***$159,000***	

Table 32. Personnel costs per year

3.8.4. Total helpdesk costs, 10 years

The table below contains the total data from the previous tables (Table 30 to Table 32), multiplied by 10 (10 years)

	Min	**Max**
Initial	$24,500	$44,000
Operational	$181,800	$576,000
Personnel	$1,080,000	$1,590,000
Total	$1,286,300	$2,210,000

Table 33. Total helpdesk costs per year

3.9. COSTS TO ADAPT NATIONAL SYSTEM INTERFACES

3.9.1. Assumptions

At present, TIR Carnet data is entered in and processed by all national IT systems (If this is not the case, the eTIR User Interface module is an option, which could be considered).

The EU countries (and candidate countries), the common transit system and Turkey use NCTS to key in TIR Carnet data. In Russia and Ukraine, similar systems are used. The systems are well known and cover all processes. We consider that there will be no changes in the current way of working with the system, which would involve training. Only the costs of development are considered important and, thus, presented here.

Developing interfaces between actual national Customs IT systems and the eTIR international system requires:

- Changes in actual national systems, so that all information required by the eTIR international system can be entered;
- Changes in actual national systems, so that the business processes which interfere with TIR Carnets are able to exchange data with the eTIR international system;
- Development of software interfaces (web services) for the eTIR international system.

The interfaces are the same for all eTIR implementations (At premises, UNOG, IaaS, PaaS).

For the evaluation of the costs of the eTIR national interfaces, we are using the analogy with the development of similar systems used, in this case:

the development of the NCTS-TIR and its integration into the full NCTS system.

In order to develop this system in 3 countries, we consider that the whole development process, using RUP methodology, involves 3 persons for a period of 3- 6 month (10-20 man/month), depending on the qualifications of the team and their knowledge of national Customs IT systems.

We present here the costs in current USD.

3.9.2. Cost evaluation

For the estimation we consider the following development schedule:

WBS	Name	Duration	Scheduled Work
1	**eTIR National Interfaces**	66 days	270 days
1.1	**Inception**	6 days	12 days
1.1.1	Startup	1 day	2 days
1.1.2	Prepare Inception report	5 days	5 days
1.1.3	Project Quality Plan	5 days	5 days
1.2	**Elaboration**	10 days	60 days
1.2.1	**Specifications**	10 days	30 days
1.2.1.1	Application Specifications Document	5 days	5 days
1.2.1.2	Technical Specifications Document	5 days	5 days
1.2.1.3	Security Specifications Document	5 days	5 days
1.2.1.4	Interoperability Specifications	5 days	5 days

1.2.1.5	Business Process Modeling	5 days	5 days
1.2.1.6	Acceptance Test Scenarios Document	5 days	5 days
1.2.2	**eTIR Interfaces System Design**	5 days	20 days
1.2.2.1	Service Model	5 days	5 days
1.2.2.2	Data Model	5 days	5 days
1.2.2.3	Technical design document	5 days	5 days
1.2.2.4	Business Processes treatment	5 days	5 days
1.2.3	eTIR Interfaces Proof Of Concept	5 days	10 days
1.3	**Construction**	39 days	131 days
1.3.1	**Specifications**	6 days	12 days
1.3.1.1	Detailed Application Specifications Document	3 days	3 days
1.3.1.2	Detailed Technical Specifications Document	3 days	3 days
1.3.1.3	Detailed Security Specifications Document	3 days	3 days
1.3.1.4	Detailed Interoperability Specifications	3 days	3 days
1.3.2	**eTIR Interfaces Detailed Design**	3 days	9 days
1.3.2.1	Data Model	3 days	3 days
1.3.2.2	Communication Model	3 days	3 days

1.3.2.3	Interface specifications	3 days	3 days
1.3.3	**eTIR Interfaces Development**	20 days	80 days
1.3.3.1	Changes in Data Capture and presentation	10 days	20 days
1.3.3.2	XML parsing and processing	10 days	20 days
1.3.3.3	Business process treatment	10 days	20 days
1.3.3.4	Web Services	10 days	20 days
1.3.4	**Unit and Integration Testing**	10 days	30 days
1.3.4.1	Test Data entry system	5 days	10 days
1.3.4.2	Test Business Process system	5 days	10 days
1.3.4.3	Tests web (WS) Interfaces	5 days	10 days
1.4	**Transition**	10 days	40 days
1.4.1	Update specifications and design documents	5 days	10 days
1.4.2	Changes in system, as required by the results of tests	5 days	10 days
1.4.3	Acceptance tests	10 days	20 days
1.5	Project Execution, Monitoring and Control	52 days	26 days
1.6	Close-up	1 day	1 day

Table 34. Effort estimation for National IT system

Based on the schedule previously presented (which is considered as minimum and requiring the employment of a highly qualified team), we have the following costs for each national system:

	Min	***Max***	***Explanation***
Development	**$103,032**	**$125,000**	**~13 Man/month * $8000 minimum costs or 25 Man/Month * $5000 maximum costs**

Table 35. Cost per country, to adapt National IT system

Considering the 68 countries in TIR convention, the total costs might be

	Min	***Max***	***Explanation***
Development	**$7,006,205**	**$8,500,000**	**~13 Man/month * $8000 minimum costs or 25 Man/Month * $5000 maximum costs** **68 countries**

Table 36. Total costs to adapt all National IT systems

3.10. COSTS FOR TRANSPORT OPERATORS

3.10.1. Assumptions

Transport operators are supposed to be in one of the situations:

A. They already have their own systems where they register data. Using a system-to-system connection, they are exchanging data with national Customs IT systems;

B. They are using a third party system (like IRU's TIR-EPD) to exchange data with national Customs IT systems;
C. They are using declaration mechanisms of national Customs ICT systems to exchange data directly with Customs ;
D. They do not register TIR data in any system.

3.10.2. Costs for eTIR adoption

For categories A, B and C, we consider that there are no necessary costs, as they will continue to work as in present. It will be the national Customs IT applications which will be interfaced with the eTIR international system. Changes, if any, are small and not relevant for the present cost estimations.

Transport operators in category D will have the possibility to use solutions B and C for free.

In conclusion, we consider that there are no real costs involved for the Trader community.

3.11. TOTAL COSTS PER 10 YEARS OF USAGE, CURRENT USD

The total costs for 10 years of usage are presented below.

The following costs will be taken into consideration:

- Development of the eTIR solution (see Chapters 2 and 3.4)
- Initial costs (see Chapter 3.5);
- Operations costs (maintenance, daily operations, etc) (see Chapter 3.6);
- Cloud usage costs (see Chapter 3.7).

The minimum and maximum costs are presented for the following types of implementation:

- At premises;
- UNOG;
- UNICC;
- IaaS;
- PaaS;
- SaaS.

In this distribution of costs, helpdesk costs and national Customs system interfaces are not included, as they are the same for all implementations and are equally distributed.

We make this presentation for 4 scenarios:

1. All TIR Carnets registered;
2. 50% of TIR Carnets registered;
3. 25% of TIR Carnets registered;
4. 10% of TIR Carnets registered.

The distribution of costs for changing national Customs IT systems is not relevant, as different countries use a very different number of TIR Carnets. However, the effort to adapt national IT systems is almost the same for all countries.

The costs below are in terms of current USD. No discounts and/or risk rates are applied. This is the base input for next chapter where discounts and risk rates are applied.

3.11.1. Total costs per 10 years of full usage table (helpdesk not included)

	Development		Initial costs		Operations Year X 10		Cloud year X 10		Total	
Impl. Type	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*	*Min*	*Max*
At premises	$924,800	$1,127,000	$1,255,000	$1,450,000	$3,404,190	$5,260,590	$0	$0	$5,583,990	$7,837,590
UNOG	$924,800	$1,127,000	$681,500	$792,500	$847,390	$1,032,590	$1,100,000	$1,400,000	$3,553,690	$4,352,090
UNICC	$924,800	$1,127,000	$632,000	$743,000	$847,390	$1,032,590	$829,800	$1,538,000	$3,233,990	$4,440,590
IaaS	$924,800	$1,127,000	$632,000	$743,000	$847,390	$1,032,590	$286,626	$498,675	$2,690,816	$3,401,265
PaaS	$924,800	$1,127,000	$192,000	$243,000	$640,000	$780,000	$951,160	$1,028,160	$2,707,960	$3,178,160
SaaS			$60,000	$75,000			$15,000,000	$30,000,000	$15,060,000	$30,075,000

Table 37. Total costs per 10 years of full usage table (helpdesk not included)

(for SaaS, a minimum of $0.5 per eTIR Carnet and a maximum of $1 per TIR Carnet is computed)

The first two columns of this table reflect the development costs, presented in Table 15, Chapter 3.4.

The columns 3 and 4 reflect the initial costs estimations, presented in Table 22, Chapter 3.5.5.

The columns 5 and 6 reflect the estimations of operational costs per year, multiplied by 10 and initially presented in Table 28, Chapter 3.6.2.

Columns 7 and 8 reflect cloud costs, as presented in Table 29.

This table reflects in Summary also Table 39 of Chapter 3.12.1 and Table 40 of Chapter 0.

The above table illustrates a system, configured to treat all TIR Carnets. The fact that the system is used from the very beginning to treat all TIR Carnets, or part of them, is reflected in the cost per TIR Carnet. As the initial costs are the same for all scenarios, the more TIR Carnets are registered, the lower the price per TIR Carnet. This situation is reflected in the following table, where costs are calculated for 4 scenarios: All TIR Carnets registered, 50% (1 500 000 per year), 25% (750 000 per year) and 10% (300 000 per year).

	100%	50%	25%	10%
No TIR Carnets	3000000	1500000	750000	300000
Min	$1.86	$3.72	$7.45	$18.61
Max	$2.61	$5.22	$10.45	$26.12

3.11.2. Total costs per 10 years of gradually usage table (helpdesk not included)

The first two columns of this table reflect the development costs, presented in Table 15, Chapter 3.4 (and are the same as for eTIR started for all TIR Carnets from the beginning);

The columns 3 and 4 reflect the initial costs estimations presented in Table 22, Chapter 3.5.5 (and are the same as for eTIR started for all TIR Carnets from the beginning);

The columns 5 and 6 reflect the estimation of operational costs gradually distributed, as presented in detail in Table 41, Chapter 3.12.2 and Table 42, Chapter 3.12.2.

Columns 7 and 8 reflect the estimation of operational costs gradually distributed, as presented in detail in Table 41, Chapter 3.12.2 and Table 42, Chapter 3.12.2.

	Development		Initial costs		Operations total		Cloud year X 10		Total	
Impl. Type	***Min***	***Max***	***Min***	***Max***	***Min***	***Max***	***Min***	***Max***	***Min***	***Max***
At premises	$924,800	$1,127,000	$1,255,000	$1,450,000	$2,210,000	$3,230,000	$0	$0	$4,389,800	$5,807,000
UNOG	$924,800	$1,127,000	$681,500	$792,500	$1,190,000	$1,360,000	$1,100,000	$1,400,000	$2,796,300	$3,224,000
UNICC	$924,800	$1,127,000	$632,000	$743,000	$850,000	$1,360,000	$829,800	$1,538,000	$2,406,800	$3,174,500
IaaS	$924,800	$1,127,000	$632,000	$743,000	$680,000	$1,020,000	$286,626	$498,675	$2,236,800	$2,834,500
PaaS	$924,800	$1,127,000	$192,000	$243,000	$1,020,000	$1,020,000	$951,160	$1,028,160	$2,136,800	$2,364,500
SaaS			$60,000	$75,000			$8,560,000	$17,105,000	$8,620,000	$17,180,000

Table 38. Total costs per 10 years of gradually usage table (helpdesk not included)

3.12. DISTRIBUTION OF COSTS DURING A 10 YEARS LIFE CYCLE, CURRENT USD

We consider a 10 year usage of the system.

- According to the results of Chapter 2, 2 years of development time are considered. This leads to a total of a 12 years period of analysis.
- The initial costs are distributed as follows:
- 50% development costs in the first year;
  50% development costs in the second year

;

- 50% initial costs in the second year;
- 50% initial costs in the third year, overlapping the first year of operation.

The yearly costs are calculated for the two scenarios:

- Equally distributed, considering that the eTIR system will be used for all TIR transports from the beginning;
- The eTIR system will be gradually implemented.

The costs below are in current USD without consideration of potential risks. These are is the base figures to which discounts and risk rates are applied.

3.12.1. eTIR usage equally distributed

Min. costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Total
			3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	
premises	462,400	1,089,900	967,919	340,419	340,419	340,419	340,419	340,419	340,419	340,419	340,419	340,419	5,583,990
UNOG	462,400	803,150	535,489	194,739	194,739	194,739	194,739	194,739	194,739	194,739	194,739	194,739	3,553,690
UNICC	462,400	778,400	483,719	167,719	167,719	167,719	167,719	167,719	167,719	167,719	167,719	167,719	3,233,990
IaaS	462,400	778,400	429,402	113,402	113,402	113,402	113,402	113,402	113,402	113,402	113,402	113,402	2,690,816
PaaS	462,400	558,400	255,116	159,116	159,116	159,116	159,116	159,116	159,116	159,116	159,116	159,116	2,707,960
SaaS	0	30,000	1,530,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	1,5 00,000	15,060,000

Table 39. Distribution of costs, per 10 years usage, eTIR started for all countries from the beginning (Minimum costs)

Max. costs	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Total
			3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	3000000	
Premises	$563,500	$1,288,500	$1,251,059	$526,059	$526,059	$526,059	$526,059	$526,059	$526,059	$526,059	$526,059	$526,059	$7,837,590
UNOG	$563,500	$959,750	$639,509	$243,259	$243,259	$243,259	$243,259	$243,259	$243,259	$243,259	$243,259	$243,259	$4,352,090
UNICC	$563,500	$935,000	$628,559	$257,059	$257,059	$257,059	$257,059	$257,059	$257,059	$257,059	$257,059	$257,059	$4,440,590
IaaS	$563,500	$935,000	$524,626	$153,126	$153,126	$153,126	$153,126	$153,126	$153,126	$153,126	$153,126	$153,126	$3,401,265
PaaS	$563,500	$685,000	$302,316	$180,816	$180,816	$180,816	$180,816	$180,816	$180,816	$180,816	$180,816	$180,816	$3,178,160
SaaS	$0	$37,500	3,037,500	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	30,075,000

Table 40. Distribution of costs, per 10 years usage, eTIR started for all countries from the beginning (Maximum costs)

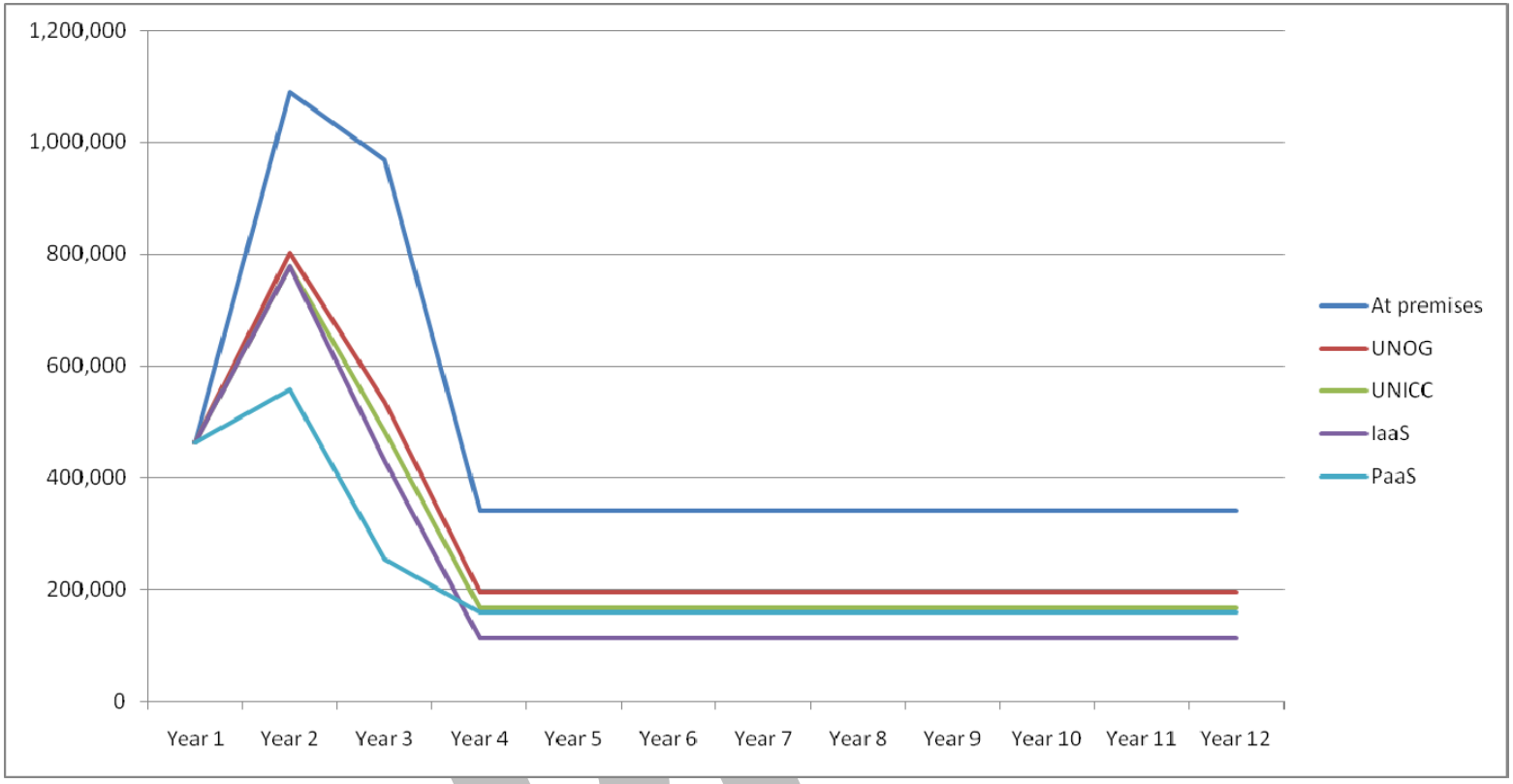

Fig 2. Minimum cost, equally distributed

3.12.2. Gradually distributed eTIR usage

Minimum costs

gradually Min	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Total
N° eTIR			100000	700000	800000	1200000	1300000	2000000	2500000	2600000	2800000	3000000	
At premises	$462,400	$1,089,900	$640,500	$91,000	$104,000	$156,000	$169,000	$260,000	$325,000	$338,000	$364,000	$390,000	$4,389,800
UNOG	$462,400	$803,150	$347,750	$49,000	$56,000	$84,000	$91,000	$140,000	$175,000	$182,000	$196,000	$210,000	$2,796,300
UNICC	$462,400	$778,400	$321,000	$35,000	$40,000	$60,000	$65,000	$100,000	$125,000	$130,000	$140,000	$150,000	$2,406,800
IaaS	$462,400	$778,400	$320,000	$28,000	$32,000	$48,000	$52,000	$80,000	$100,000	$104,000	$112,000	$120,000	$2,236,800
PaaS	$462,400	$558,400	$102,000	$42,000	$48,000	$72,000	$78,000	$120,000	$150,000	$156,000	$168,000	$180,000	$2,136,800
SaaS	$0	$30,000	$80,000	$350,000	$400,000	$600,000	$650,000	$1,000,000	$1,250,000	$1,300,000	$1,400,000	$1,500,000	$8,560,000

Table 41. Distribution of costs, per 10 years usage, eTIR started for all countries from the beginning (Minimum costs)

(for SaaS, $1 per eTIR Carnet is calculated)

Maximum costs

gradually Max	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Total
N° eTIR			100000	700000	800000	1200000	1300000	2000000	2500000	2600000	2800000	3000000	
At premises	$563,500	$1,288,500	$744,000	$133,000	$152,000	$228,000	$247,000	$380,000	$475,000	$494,000	$532,000	$570,000	$5,807,000
UNOG	$563,500	$959,750	$348,750	$56,000	$64,000	$96,000	$104,000	$160,000	$200,000	$208,000	$224,000	$240,000	$3,224,000
UNICC	$563,500	$935,000	$7,000	$49,000	$56,000	$84,000	$91,000	$140,000	$175,000	$182,000	$196,000	$210,000	$3,174,500
IaaS	$563,500	$935,000	$322,000	$42,000	$48,000	$72,000	$78,000	$120,000	$150,000	$156,000	$168,000	$180,000	$2,834,500
PaaS	$563,500	$685,000	$102,000	$42,000	$48,000	$72,000	$78,000	$120,000	$150,000	$156,000	$168,000	$180,000	$2,364,500
SaaS ($)	$0	$37,500	$130,000	$737,500	$800,000	$1,200,000	$1,300,000	$2,000,000	$2,500,000	$2,600,000	$2,800,000	$3,000,000	$17,105,000

Table 42. Distribution of costs, per 10 years usage, eTIR started for all countries from the beginning (Minimum costs)

(for SaaS, $1 per eTIR Carnet is calculated)

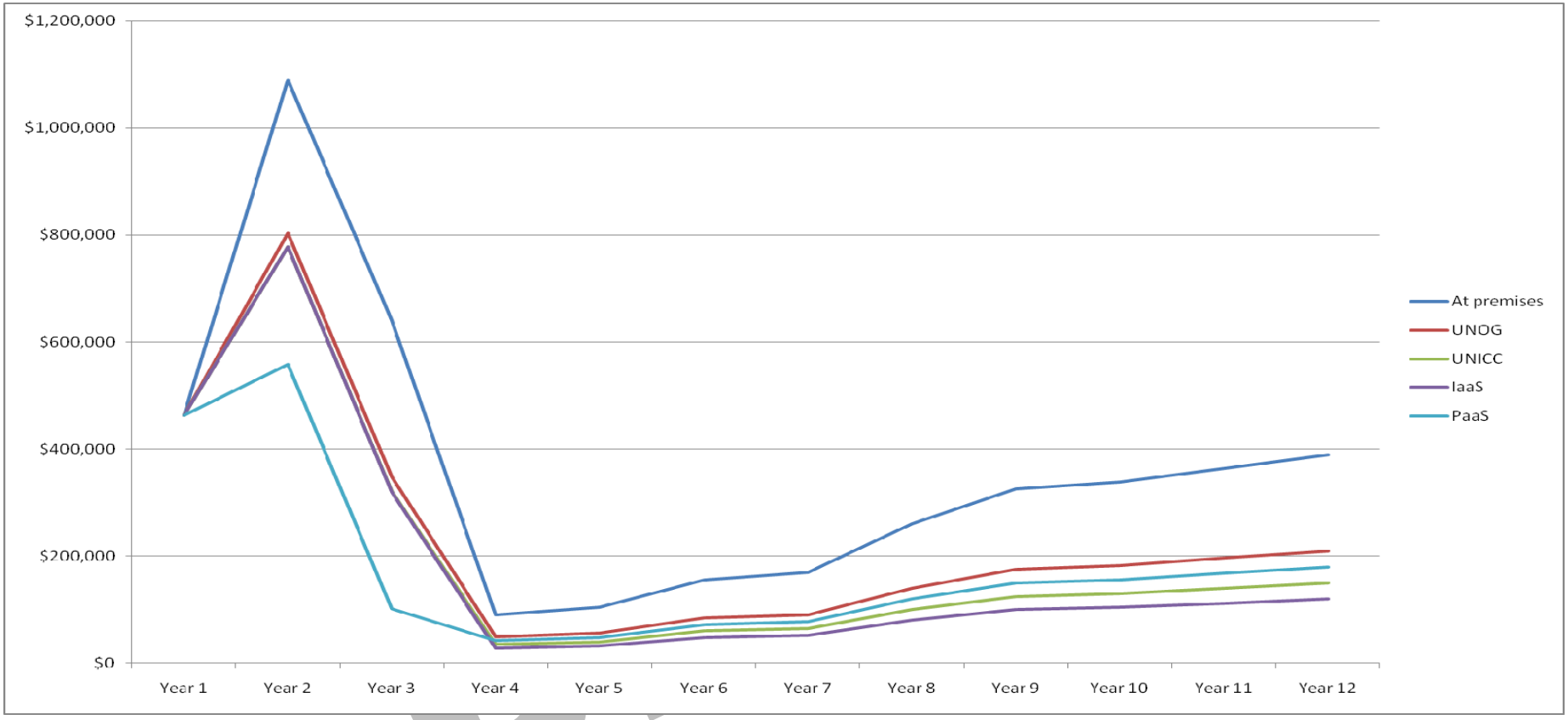

Fig 3. Minimum cost, gradually distributed

SaaS Costs gradually distributed, compared with others)

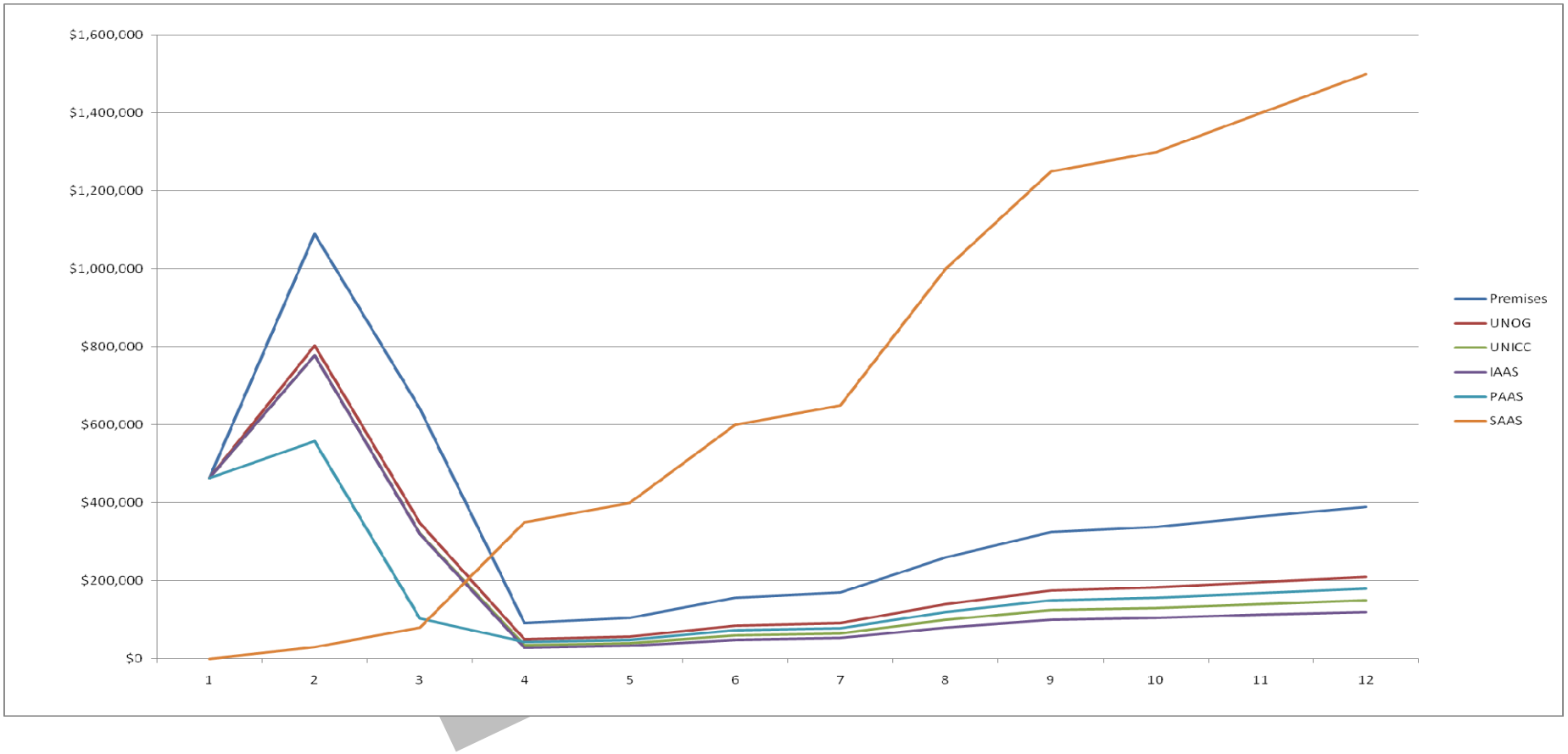

Fig 4. SaaS Costs gradually distributed, compared with others)

ANNEXES

Annex 0 - UNECE-eTIR_CBA-EST-ANNEX-0-REF-v02-31.docx

Annex I – UNECE-eTIR_CBA-EST-ANNEX-I-FPA-V05-11.docx

Annex II- UNECE-eTIR_CBA_EST-ANNEX-II-CLOUD_OFFERS.docx

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