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Abstract:

The D6.3 – *Report on validation results Version I* aims at defining and describing the overall validation process and methods adopted to assess the LETSCROWD outcomes and reporting the main results of the LETSCROWD outcomes assessment carried out in the first cycle of practical demonstrations. The LETSCROWD validation approach is based on the principles of the *Human centred design approach* (HCD) by integrating the user's perspective into the tools development. In the HCD approach a distinction between *formative* and *summative evaluation* is usually made. This document reports the results and recommendations that are part of the formative evaluation.

Keywords:

Formative and Summative evaluation, validation criteria, usability, usefulness, effectiveness, maturity level, validation toolkit, practical demonstrations, recommendations, requirements

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Executive Summary

The report D6.3 – *Report on validation results Version 1* aims at defining and describing the overall validation process and methods adopted to assess the LETSCROWD outcomes. The LETSCROWD validation approach is based on the principles of the Human centred design approach (HCD). It aims to integrate the user's perspective, needs and requirements into the tools development process in order to collect feedback their feedback at key points of the project lifecycle. The validation process and the main results described in this document have to be considered as part of the iterative approach leading the LETSCROWD outcomes development. It thought to keep the end-users in the loop throughout the duration of the project to ensure that the final version of the human-centred toolkit and the other LETSCROWD outcomes are as close as possible to their needs and requirements.

The main objectives of the validation process are:

- to assess the core components and functionalities of the LETSCROWD outcomes at a preliminary stage in order to provide early feedback to the project, and to allow initial adjustments and revisions (first cycle of practical demonstrations from November 2018 to February 2019)
- to validate the final deployment of the LETSCROWD outcomes within an operational environment that has to be simulated as closely as possible to real-world working environments. The second cycle of practical demonstrations will be carry out from May 2019 to August 2019 M28.

In particular the first cycle of PDs aimed to:

- Assess the LETSCROWD tools at preliminary stages of the development process;
- Use exercises to test specific components and functionalities of the tools;
- Get feedback from operational experts (LEAs and first responders) in order to refine the tools;
- Test the preliminary integration of the LETSCROWD outcomes into a unique tool: the LETSCROWD server (see section 4.1.9). During the final PD in Munich (PD5) a first version of the LETSCROWD Server (LS) was validated. It aims to integrate the different tools developed within the project such as: RTE, CMPT, SIE and HCV in order to support LEAs in managing mass gatherings.

Given that the LETSCROWD outcomes are different and each tool is characterised by specific and unique features and components, a validation toolkit was developed to facilitate the data collection during the execution of the practical demonstrations. The validation toolkit consists of quantitative and qualitative validation instruments, i.e.:

- The validation questionnaire (see section 2.4.1);
- The debriefing template (see section 2.4.2);
- The requirements acceptance scale (see section 2.4.3);
- The societal impact surveys (2.4.4).

The first cycle lasted four months (from November 2018 to February 2019) and consisted of five practical demonstrations that were held in four different countries, namely: Spain, Italy, Belgium and Germany. Different LEAs were involved in the organisation of the different PDs such as Ertzaintza, ADM, INTERNO, LPV and BayFHVR.

The results collected during this first cycle were reported in the following sections:

- Section 4.1 presents an overview of the results of the first practical demonstration cycle gathered through the validation questionnaire;
- Section 4.2 reports the detailed results per each tool detailing the results collected through the validation questionnaire, the debriefing session and the requirements acceptance scales. General recommendations for further improvements of the tools were also included.



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1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

The deliverable D6.3 – *Report on validation results Version 1* aims at defining and describing the overall validation process and methods adopted to assess the LETSCROWD outcomes and reporting the main results of the LETSCROWD outcomes assessment carried out in the first cycle of practical demonstrations.

In the interactive systems/ tool development inspired by the Human-Centred Design approach, a distinction between *formative* and *summative evaluation* is usually made. This document reports the results and recommendations that are part of the formative evaluation. While the deliverable D6.6 – *Report on validation results* due at M30, will present the summative evaluation results.

1.2 SCOPE OF THE DOCUMENT

This document aims to:

- Synthetize the validation approach adopted within PDs for assessing the preliminary versions of the LETSCROWD tools;
- Describe the first cycle of practical demonstrations;
- Present the main results gathered and propose suggestions for further improvements of the tools.

1.3 STRUCTURE OF THE DOCUMENT

This document is structured around four main sections as follows:

- Section 2 describes the validation approach adopted within the project by detailing the validation objectives, the validation criteria and the validation methods used during the practical demonstration;
- Section 3 presents an overview of the five practical demonstrations carried out during the first cycle;
- Section 4 presents the main results collected during the first cycle of PDs. The chapter is structured into two main sections:
 - Section 4.1 presents an overview of the results of the first practical demonstration cycle gathered through the validation questionnaire;
 - Section 4.2 reports the detailed results per each tool detailing the results collected through the validation questionnaire, the debriefing session and the requirements acceptance scales.
- Finally Section 5 reports the main conclusions.

2 LETSCROWD VALIDATION PROCESS

2.1 FORMATIVE AND SUMMATIVE EVALUATION

This section compares the two complementary functions of evaluation coherently linked to the *Human-centred design approach* (HCD) (1); (2); (3), that is the inspiring principle of the LETSCROWD project. HCD aims at incorporating the user's perspective into the tool development process to achieve a usable system meeting users' needs, as described in the (4):

Human-centered design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, usability knowledge, and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance.

According to (5), the iterative development process typically consists of three main stages of initial, prototype and final design (see Figure 1), to which two different types of evaluation are applied with different functions.

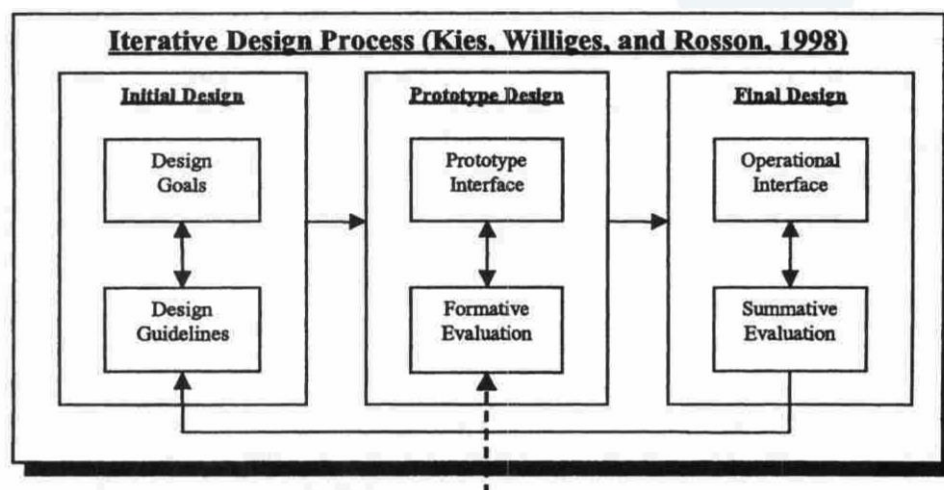


Figure 1: Iterative Design Process and Evaluation

The *formative evaluation* (FE) is typically conducted in the prototype phase, during the development of a specific tool/ system/ product. At this stage, FE aims at identifying system problems and to improve the development process. The focus is on usability problems that need to be solved before the final design of the tool can be released (6). Usability problems concern tool's efficiency, effectiveness and satisfaction from the end-user perspective.

For the FE easy and quick exercises sessions may be sufficient to test the main tool's components and functionalities. A combination between user and expert-based evaluation methods could enhance the FE process.

Otherwise, the *summative evaluation* (SE) involves making judgements about the efficacy of a tool/ system/ product at its conclusion (Hartson, Andre, Will, 2003). It aims at finding out whether people can use the product successfully (Maguire, 2001) in real-world working environments that usually have to be simulated as closely as possible during the evaluation sessions.

For carrying out both the formative and summative evaluation, user-based methods (e.g. thinking-aloud, evaluation workshops; assisted evaluation with an observing human factors specialist; usability questionnaire/ scales) or expert-based methods can be applied (e.g. heuristic or expert evaluation). Often, formative evaluation is associated with qualitative data concerning the identification of specific usability problems and the summative evaluation with quantitative data related to user performance metric data.

The LETSCROWD validation approach adopts an integrated methodological approach both for the formative and summative evaluations, collecting qualitative and quantitative data, as described in detail in sections 2.4 and 2.5.

2.2 VALIDATION OBJECTIVES

Generally speaking, the validation process aims to collect feedback from end-users at key points of the project lifecycle.

Thus, the evaluation process and the main results described in this document have to be considered as part of the iterative approach leading the LETSCROWD outcomes development. Indeed the evaluation process was thought to keep the end-users in the loop throughout the duration of the project to ensure that the final version of the human-centred toolkit and the other LETSCROWD outcomes are as close as possible to their needs and requirements.

The main objectives of the validation process are to:

- assess the core components and functionalities of the LETSCROWD outcomes at a preliminary stage in order to provide early feedback to the project, and to allow initial adjustments and revisions (first cycle of practical demonstrations from November 2018 to February 2019)
- validate the final deployment of the LETSCROWD outcomes within an operational environment that has to be simulated as closely as possible to real-world working environments. The second cycle of practical demonstrations will be carried out from May 2019 to August 2019 M28.

The validation results collected at this stage of the project aim to gather early feedback from the end-users on the LETSCROWD outcomes, to allow adjustments and revisions. The feedback collected during this preliminary stage will allow:

- *technology providers* to gather suggestions to improve the tools/ software/ methodologies they are developing. The feedback collected through this phase will be used to refine and adjust the tools for their final release.
- *end-users* to familiarise with the project outcomes and start using them, even though by means of preliminary versions.

2.3 VALIDATION CRITERIA

A set of validation criteria was identified to assess the LETSCROWD outcomes. The table below describes in detail the criteria identified, giving also an explanation of the why they have been chosen.

The selection of validation criteria was useful to develop the validation instruments (see section 2.4) and to facilitate the identification of strengths that should be sustained and gaps that should be improved or modified.

Table 1: Validation criteria description

TECHNICAL AND FUNCTIONAL CRITERIA	DESCRIPTION	RATIONALE
1. USEFULNESS	Degree to which the LETSCROWD outcomes are able to meet users' needs.	Core criteria for a human- centred approach
2. USABILITY	<p>Degree to which the LETSCROWD outcomes and software are reasonably easy to understand and use.</p> <p>Usability concerns the perceived use of the outcome. According to ISO 9241-11, its measure should cover:</p> <ul style="list-style-type: none"> ➤ the degree of success with which users achieve their task goals (Effectiveness); ➤ the time it takes to complete tasks (Efficiency); ➤ the user comfort and acceptability of the outcome (Satisfaction). 	
3. COMPATIBILITY	Degree to which the LETSCROWD outcomes are considered compatible with already existing practices within a specific context/organisation and regulations of reference e.g. privacy, legal and ethical regulations.	
4. MATURITY	Assessment of the Technology Readiness Level (TRL) of the LETSCROWD outcomes.	Key criteria to assess Project TRL (from the DoA)
5. SOCIAL IMPACT	Assessment of the perceived impact and consequences of the LETSCROWD outcomes development on society (from LEAs, first responders and citizens' perspectives).	Key criteria indicated in the DoA

2.4 THE VALIDATION TOOLKIT

Given that the LETSCROWD outcomes are different and each tool is characterised by specific and unique features and components, a validation toolkit was developed to facilitate the data collection during the execution of the practical demonstrations.

The validation toolkit consists of quantitative and qualitative validation instruments, i.e.:

- The validation questionnaire;
- The debriefing template;
- The requirements acceptance scale;
- The societal impact surveys.

Each validation tool allows collecting data on specific validation criteria, as specified in Table 2.

Table 2: Validation tools addressing validation criteria

TECHNICAL AND FUNCTIONAL CRITERIA	VALIDATION INSTRUMENTS
1. USEFULNESS	<ul style="list-style-type: none"> Validation Questionnaire Debriefing session Requirements acceptance scales
2. USABILITY	
3. COMPATIBILITY	
4. MATURITY	
5. SOCIAL IMPACT	Social Impact assessment online surveys – See D6.4

A detailed description of the validation toolkit components is provided in the following sections (see 2.4.1, 2.4.2, 2.4.3, 0).

The validation instruments were thought to be generic and flexible enough to collect data coming from different tools and methods characterised by specific features and maturity levels.

2.4.1 Validation questionnaire

The validation questionnaire (see ANNEX A Level 1- 7.2 Validation questionnaire) is composed of three main sections that allow collecting data on the identified validation criteria, i.e.: usefulness, usability, compatibility and tools/ software level of maturity.

A specific consent form opens the questionnaire and anticipates the three sections. It is followed by general questions about the interviewee's demographic information (i.e. country/ region; age; gender; socio-professional category).

The **first section** assesses the **usefulness** of the specific LETSCROWD outcome through three questions. The first of them aims at gathering user's perception of the tool usefulness when dealing with mass gatherings (5-points Likert scale). The other open questions ask the interviewee to assess what features s/he considers most and least important about the tool, and why.

The **second section** includes the *System Usability Scale* (SUS) (released by (7)). It was originally created as a "quick and dirty" scale for administering after usability tests on systems to collect the subjective assessments of usability. It is applicable to a wide variety of products and services, including hardware, software, mobile devices, websites and applications. The benefits of using a SUS are the following¹:

- It has become an industry standard, with references in over 1300 articles and publications;
- It is an easy scale to administer to participants;
- It can be used also on small sample sizes with reliable results;
- It can effectively differentiate between usable and unusable systems/ products.

¹ SUS benefits have been described at this link: <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

SUS consists of 10 standard questions with 5 options to choose from (ranging from *strongly disagree* to *strongly agree*). Lewis and Sauro (8) pointed out that the SUS can be intended not only to measure the perceived ease-of-use of a specific system, but it provides also a global measure of system satisfaction and sub-scales of usability and learnability. In particular, items 4 and 10² provide the learnability dimension and the other 8 items provide the usability dimension³.

The second section of the validation questionnaire also includes three more items to be assessed through the same 5 point Likert-scale used in the SUS. One of them addresses the *effectiveness* dimension, while the other two concern the *compatibility* of the LETSCROWD outcome with the already existing practices within a specific context/organisation. An open question - included to gather any other comments related to the use of the specific LETSCROWD tool - closes this section.

The **third and last section** collects the interviewee's assessment of the *Technology Readiness Level* (TRL) of the LETSCROWD outcome. The TRL considered range from the level 3 to the level 6 as expected by the project.

The final open question aims to collect suggestions about any other specific issues concerning the evaluation of the LETSCROWD tool.

The validation questionnaire is anonymous and it has been administrated by each technology provider to the LEAs/ first responders at the end of the practical demonstration. The online version of the validation questionnaire is available at this link: <https://www.surveymonkey.com/r/F2V3LF6>.

2.4.2 Debriefing session

The validation questionnaire described above and especially the *System Usability Scale* provide quantitative data for the validation assessment, but it may be difficult to understand why users assigned a specific low or high score to the scales included, without additional qualitative data (9).

Thus, once LEAs and/ or first responders who took part at the PD have filled out the questionnaire, the technology provider asked participants to discuss, at general level, the answers provided by means of a debriefing session (group session). The technology provider was in charge of guiding the discussion, going throughout the questionnaire (see Annex A Level 3 – 7.3 Debriefing template section) and facilitating the debate among the different points of view. One or two note takers helped the technology provider in charge of the facilitation by writing down all the gathered feedback and comments (i.e. qualitative reporting). Notes taken during the debriefing session have been analysed as validation results together with the quantitative data collected through the questionnaire.

2.4.3 Requirements acceptance scale

This instrument (see ANNEX A – 7.4 Requirements acceptance scale) aims at validating the requirements that have been defined in the first stage of the project by each technology provider (see D2.1 - *Project Requirements Definition*). Before validating the project requirements, an update of the requirements was asked to the technology providers in order to verify their adequateness taking into account the current development status of the LETSCROWD outcomes. Given that the first requirements-sets were established

² SUS - Item 4: *I think that I would need the support of a technical person to be able to use this system*;
SUS – Item 10: *I needed to learn a lot of things before I could get going with this system*.

³ <https://measuringu.com/sus/>

before the development process, a possible deviation and subsequent realignment of the requirements have been considered. The requirements updates have been included in the ANNEX C (section 9).

In this first validation phase, requirements have been validated at several levels, i.e. considering:

- the **type of validator** (technology provider or LEA expert/ first responder). As underlined by the technology providers, users can validate only those requirements referred to tool's components and functionalities that are directly used during the practical demonstration, when carrying out specific tasks. On the contrary, some other requirements are less "visible" for the users since they refer to very technical and basic aspects of the tool (e.g. *the crowd monitoring tool will process videos acquired by standard, fixed or PTZ, video surveillance colour cameras. Tilt angle with horizontal plane: about 45 degrees or more; height: about 5 m or more*). These types of requirements have been validated through the technology providers' expert judgment. In both cases (technology provider or LEA expert/ first responder) a detailed rationale was requested to collect the reasons behind the assessment provided. For this purpose, the requirement acceptance scales included a column where it was mandatory to write down a detailed rationale for the assessment done with respect to each requirement.
- the **requirements "maturity" level**. All the requirements, including those still "immature", have been assessed in the first practical demonstration cycle, taking into account the current development status of the LETSCROWD tools. In this case, the technology provider evaluated their level of acceptance as very low at this first assessment stage. The rationale included in the scales allowed explaining why.

Whatever strategy was used by the technology providers to assess the requirements (i.e. exercises carried out in the PD, i.e. test cases – see Annex D – section 10), the collected answers were reported in the requirements acceptance scales prepared for each LETSCROWD tool, in order to facilitate the analysis process. Each requirement acceptance scale has been validated by means of 3 points Likert-scale (i.e. *agree, partially agree, disagree*).

2.4.4 Societal impact surveys

Two online surveys have been set up to assess the societal impact of the LETSCROWD outcomes (see D6.4 - *Progress report on Societal Impact Report* for a detailed description of both of them). One survey is addressed to citizens; the other one to Law Enforcement Agencies and first responders involved in the project.

Feedback regarding the societal impact will be collected throughout the duration of the two practical demonstration cycles by using the following link:

- EUROPEAN CITIZENS' ATTITUDE TOWARDS SECURITY IN MASS GATHERINGS EVENTS - <https://www.surveymonkey.com/r/C567CWC>
- LAW ENFORCEMENT AGENCIES AND FIRST RESPONDERS' ATTITUDE TOWARDS SECURITY IN MASS GATHERINGS EVENTS - <https://www.surveymonkey.com/r/933Q86S>

All partners of the LETSCROWD consortium were asked to support the societal impact assessment process by recruiting participants and spreading out the survey among their contacts.

The two online societal impact surveys were launched in November and be closed at the end of the second PDs cycle. The results collected through the online surveys will be reported in D6.7.

2.5 VALIDATION PROCESS: FLOW AND MAIN ACTIVITIES (1ST CYCLE)

The first cycle of the LETSCROWD validation process is composed of three main steps as shown in Figure 2.

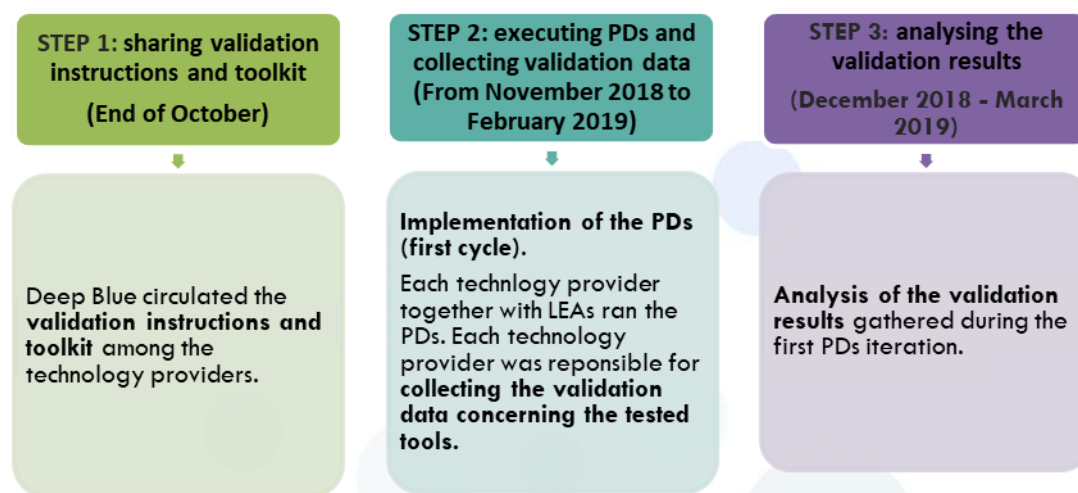


Figure 2: Validation flow

STEP 1: sharing validation instructions and toolkit. The first step for implementing the validation process was to prepare and share the **validation instructions and the validation toolkit** (see section 2.4) with the technology providers who were in charge of the assessment process of the tools/software they developed for the first round of PDs. The validation instructions (see ANNEX A - 7.1 level 1) report useful indications on the following aspects:

- The data collection process
- The validation instruments to be used

STEP 2: executing PDs and collecting validation data. The second step of the validation process was represented by the execution of the practical demonstrations in order to test the preliminary versions of the LETSCROWD outcomes and get initial feedback for the refinement of the project tools. The first cycle of PDs lasted 4 months from November 2018 to February 2019.

During the execution of each PD, a dedicated time was scheduled to carry out the validation activities. A practical demonstration **evaluation team** – composed of a technology provider and one/two note takers – was responsible for the assessment of each LETSCROWD tool. At the end of each PD, the evaluation team involved in the demonstration collected the validation data concerning the tool tested by means of the validation toolkit. The evaluation team administered the *validation questionnaires* and the *requirement acceptance scales* to the participants in order to assess the specific LETSCROWD outcome. After filled out the validation questionnaire, the evaluation team carried out a debriefing session with the PD participants to discuss the answers they provided.

The figure below shows an example of the application of the validation process during a PD.

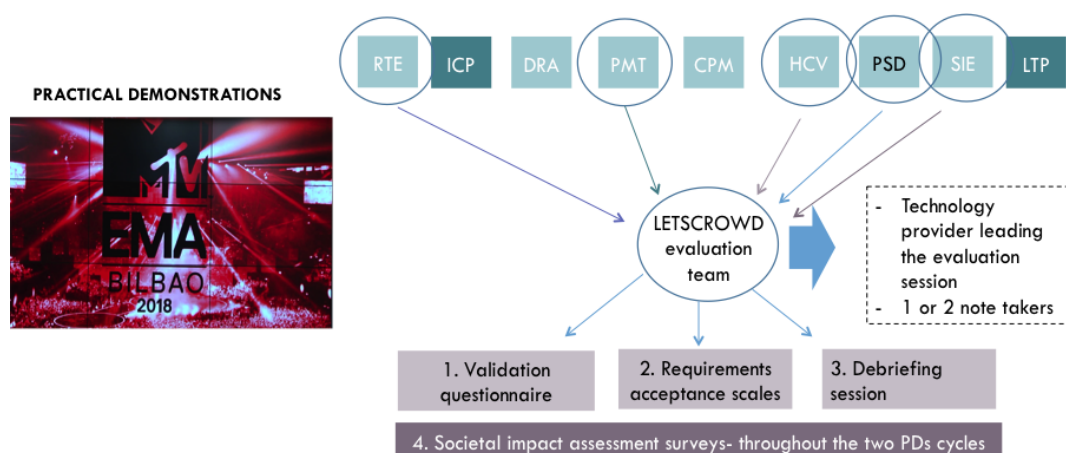


Figure 3: An example of application of the validation toolkit to the Bilbao practical demonstration

When one PD involved the assessment of more than one LETSCROWD outcomes in parallel, each outcome was tested by using the three validation methods applied by different evaluation teams. Informed consent forms were also collected before each PD.

STEP 3: analysing the validation results

All the data collected during the first round of the PDs have been included in this deliverable.

3 OVERVIEW OF THE FIRST CYCLE OF PRACTICAL DEMONSTRATIONS

As mentioned in section 2.2, the first cycle of PDs aimed to:

- Assess the LETSCROWD tools at preliminary stages of the development process;
- Use exercises to test specific components and functionalities of the tools;
- Get feedback from operational experts (LEAs and first responders) in order to refine the tools;
- Test the preliminary integration of the LETSCROWD outcomes into a unique tool: the LETSCROWD server (see section 4.1.9). During the final PD in Munich (PD5) a first version of the LETSCROWD Server (LS) was validated. It aims to integrate the different tools developed within the project such as: RTE, CMPT, SIE and HCV in order to support LEAs in managing mass gatherings.

The first cycle of PDs lasted 4 months, from November 2018 (M19) to February 2019 (M22). Figure 3 synthesises the main PDs carried out during the first cycle and the LETSCROWD tools tested.

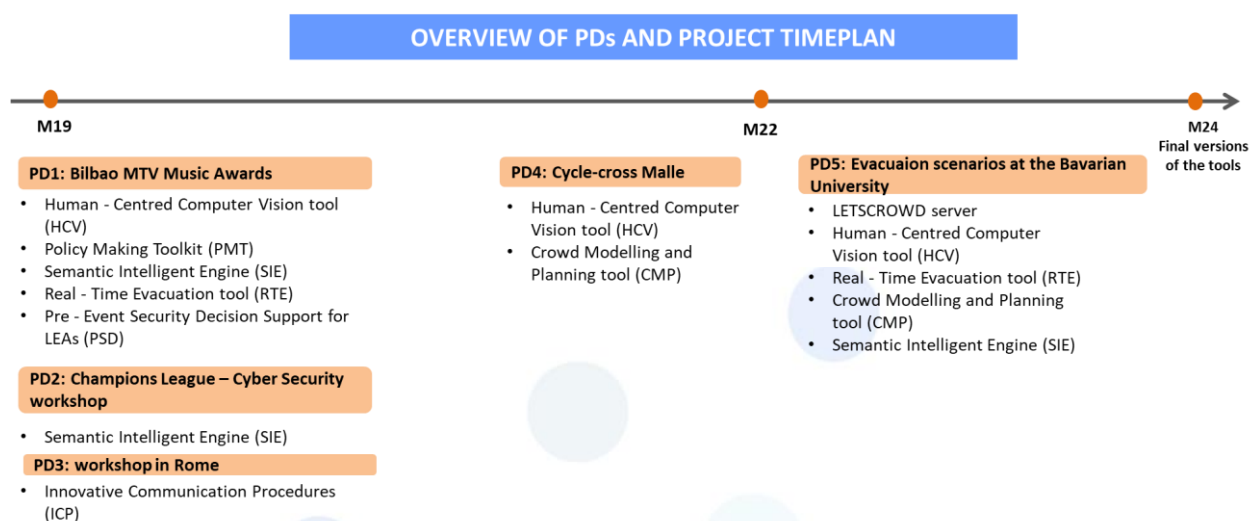


Figure 3: Overview of the first cycle of practical demonstrations and tools tested

The first cycle consists of five practical demonstrations that were held in four different countries, namely: Spain, Italy, Belgium and Germany. All the demonstrations were proposed and organised by the LEAs project partners according to their availabilities. A strong collaboration between LEAs and technology providers was requested to successfully organise the PDs. Some weeks before the execution of the demonstrations, technology providers and LEAs were asked to fill in a design template collecting all the relevant information and requests needed to carry out the testing activities (see D6.2 for further details). Preliminary communication between the technical provider and the LEA was established before the PD (via e-mails and conference calls) in order to ensure that the minimum requirements for the successful execution of the PD and the gathering of data required for the tool set-up would be reached. The following sections describe the five practical demonstrations by detailing:

- The information concerning the location, venue, duration and agenda of the day;
- Partners involved in the PD;
- Tools tested.

3.1 PD1 - BILBAO MTV MUSIC AWARDS: GENERAL DESCRIPTION

The table below synthesises the main information related to the first practical demonstration held in Bilbao during the Music Week MTV EMAs 2018. The Practical demonstration was organised by Ertzaintza with the support of ETRA, Expert System, University of Cagliari and University of Cantabria.

Table 3: Description of the PD1 - BILBAO MTV MUSIC AWARDS

Location and Venue	Bilbao, San Mames Barria Stadium (Bilbao) / Sala de Crisis Ertzaintza, Bilbao
Date	Saturday, November 3, 2018
Duration	16:30 – 23:30 h
Agenda and short description of the event	Stellar concert in the context of the Music Week MTV EMAs Bilbao 2018. Public: more than 40,000 people.
PD team (i.e. lea/s +	TP: ETRA, ESYS, UNICA, UC

technology provider/s)	LEAs: ERTZAINZA; INTERNO; ADM
Tools tested during the PD	HCV, SIE, RTE, PSD, PMT
Requested equipment/supplies	IT equipment and the management of the crisis room and the security device in the field
Other relevant information concerning the PD	The practical demonstration takes place on the occasion of a major event, in which the TPs work together with the officials who manage the event in real time. However, the tests and validations of the tools take place in parallel to the operational management in a controlled manner.



Figure 4: PD1 highlights

3.2 PD2 - ROME CHAMPION LEAGUE: GENERAL DESCRIPTION

The table below synthetises the main information related to the practical demonstration in Rome at CNAIPIC (*Centro nazionale anticrimine informatico per la protezione delle infrastrutture critiche*) facilities. The Practical demonstration was organised by the Italian Ministry of Interior with the support of Expert System, PLURIBUS ONE and the University of Cagliari.

Table 4: description of PD2 - ROME CHAMPION LEAGUE

Location and Venue	Rome - Polizia di Stato Headquarters
Date	26/27.11.2018
Duration	5 hours
Agenda and short description of the event (when applicable)	<p>26.11.2018</p> <ul style="list-style-type: none"> • Presentation of the semantic intelligence engine – 20 min • Workshop with experts to evaluate the tools – 60 min • Validation phase (administration of the validation toolkit) – 30 min <p>27.11.2018</p> <ul style="list-style-type: none"> • Cyber security workshop with CNAIPIC LEA – 180 min.
PD team (i.e. lea/s + technology provider/s)	Expert System, Pluribus One, INTERNO, ERZAINZA
Tools tested during the PD	SIE (Semantic Intelligence Engine)
Requested equipment/supplies	No need for specific equipment.
Other relevant	The activities carried out during the Cyber Security Workshop (27.11.2018) were not

information concerning the PD	meant to further evaluate the SIE and were actually an independent activity. The aim of these activities was to explain the cyber-response procedures and methodologies currently set by CNAIPIC.
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Figure 5: PD2 highlights

3.3 PD3 – ROME EVALUATION WORKSHOP: GENERAL DESCRIPTION

The table below synthesises the main information related to the practical demonstration in Rome at the Rome Police Headquarters. The Practical demonstration was organised by the Italian Ministry of Interior with the support of Deep Blue.

Table 5: Description of PD3 - Rome evaluation workshop

Location and venue	Rome Police Headquarters
Date	26.11.2018
Duration	2h
Agenda and short description of the event (when applicable)	<ol style="list-style-type: none"> 1. Presentation of the communication toolkit - 15 min 2. Workshop with experts to evaluate some components – 1h15 3. Validation phase (administration of the validation instruments) – 30 min
PD team (i.e. lea/s + technology provider/s)	Deep Blue and INTERNO
Tool/s tested	ICP (Communication Toolkit)
Requested equipment/supplies	No need for specific equipment
Actions performed to address ethical requirements	Preparation of an information sheet/ letter and an informed consent form for external PD participants containing information on what type of data would be collected during the PD, and how they would be worked out, stored and protected.
Other relevant information concerning the pd	N.A.



Figure 6: PD3 highlights

3.4 PD4 – CYCLOCROSS MALLE: GENERAL DESCRIPTION

The table below synthesises the main information related to the practical demonstration held in Belgium for the Cyclocross Oostmalle. The Practical demonstration was organised by the Lokale Politie Voorkempen (LPV) with the support of Crowd Dynamics and the University of Cagliari.

Table 6: Description of the PD4 - CYCLOCROSS MALLE

Location and venue	Cyclocross Oostmalle, Heihuizen 5/X Oostmalle – Airfield (Belgium)
Date	22 – 24.02.2019
Duration	3 days
Agenda and short description of the event (when applicable)	<p>22.02.2019</p> <ul style="list-style-type: none"> • Instalment cameras and other equipment – all day <p>23.02.2019</p> <ul style="list-style-type: none"> • Site visit – 1h • HCV test camera positions – 1h • CMPT revise event analysis/simulation set up – 1h • Dry run – 1h <p>24.02.2019</p> <ul style="list-style-type: none"> • Meet and instruct volunteers – 1h • Demo: HCV video recording/demonstration of tools – 1h • Demo: CMPT show previous analysis to officer – 30min • Demo: Officer requests some analysis for the simulation – 15min • Demo: CMPT demonstrates results of analysis – 15min • Demo: Use of HCV tool on recorded videos – 30min • Debriefing with officers – 1h • Validation phase – 1h • Dismantling cameras and equipment – 4h
PD team (i.e. lea/s + technology provider/s)	LPV – UNICA – CROWD
Tools tested during the PD	HCV (Human-centred computer vision tool) – CMPT (Crowd Modelling and Planning Tool)
Requested equipment/supplies	Mobile camera system of the Federal Police and office containers of the Civil Protection services.



Figure 7: PD4 highlights

3.5 PD5 – EVACUATION SCENARIOS AT THE UNIVERSITY OF APPLIED SCIENCES FOR PUBLIC SERVICE IN BAVARIA: GENERAL DESCRIPTION: GENERAL DESCRIPTION

The table below synthetises the main information related to the practical demonstration held in Germany at the University of Applied Sciences for Public Service in Bavaria. The Practical demonstration was organised by the Fachbereich Polizei (BayHfoeD) with the support of Crowd Dynamics, Expert System, ETRA, University of Cagliari, University of Cantabria and Zenabyte.

Table 7: Description of the PD5 - Bavarian Practical Demonstration

Location	Hochschule für den öffentlichen Dienst in Bayern – Fachbereich Polizei (BayHfoeD) University of Applied Sciences for Public Service in Bavaria – Department Police
Venue	Main Campus of BayHfoeD (Fürstenfelder Str. 29 – 82256 Fürstenfeldbruck)
Date	25.02-27.02.2019
Duration	Recording of scenes with volunteers – one full day including preparations – recording time approx. 2,5h Demonstration of tools to police officers and feedback session – approx. 3,5h
Agenda and short description of the event (when applicable)	<p>Monday, 25.02.2019</p> <ul style="list-style-type: none"> Planning session for the recording <p>Tuesday, 26.02.2019</p> <ul style="list-style-type: none"> Technical preparations of venue / dry run Briefing of volunteers and recording of scenes according to the plan <p>Wednesday, 27.02.2019</p> <ul style="list-style-type: none"> Presentation of RTE, SIE, CMP and LETSCROWD server Hands-On demo of HCV Feedback session with police officers from Bavaria <p>Description: The scope of the Bavaria PD was to gather video material by recording scenes played by volunteers. The material will be used for scientific, dissemination and demonstration purpose during the last period of the project. Different indoor and outdoor scenarios of evacuation and crowd behaviour were recorded. Overall, about 60 volunteers took part in the demo. At the last day, the tools were presented and discussed with police officers from Bavaria.</p>
PD team (i.e. lea/s + technology provider/s)	<p>Technological Partners:</p> <ul style="list-style-type: none"> ETRA I+D

	<ul style="list-style-type: none"> • Crowd Dynamics • University of Cagliari • University of Cantabria • Expert System <p>LEAs:</p> <ul style="list-style-type: none"> • Ertzaintza • Interno • Local Police Voorkempen • BayHfoeD <p>Others:</p> <ul style="list-style-type: none"> • Railsec • ZenaByte
Tools tested during the PD	<p>RTE, SIE, CMP, HCV and LetsCROWD server.</p> <p>Concerning DRA, a preliminary evaluation of how far the LETSCROWD technologies can support the DRA scenario described in D3.6 was carried out. This scenario will be tested in the second PD validation cycle.</p>
Requested equipment/ supplies	<p>Technical equipment was provided by the partners.</p> <p>University of Cagliari – System Cameras</p> <p>University of Cantabria – Go-Pro Cams</p> <p>BayHfoeD – Requisites, Camcorders</p>



Figure 8: PD5 highlights

4 RESULTS OF THE FIRST PRACTICAL DEMONSTRATIONS CYCLE

This chapter is structured into two main sections:

- Section 4.1 presents an overview of the results of the first practical demonstration cycle gathered through the validation questionnaire;
- Section 4.2 reports the detailed results per each tool detailing the results collected through the validation questionnaire, the debriefing session and the requirements acceptance scales.

It should be noted that during the first cycle of PDs the LETSCROWD tools were tested individually through small exercises. Each technology provider developed different test cases to test and validate specific functionalities of their tools based on their status of development. Therefore, comparisons among the different tools were not been possible.

4.1 GENERAL OVERVIEW

In first cycle of practical demonstrations carried out from November 2018 to February 2019, thirty-two respondents from different European law enforcement agencies filled out the validation questionnaire.

Figure 9 shows information about age, where most of the participants were aged 45 to 54.

The geographical distribution of the participants shown in Figure 10 likely reflects the national countries where the PDs were organised, namely: Italy, Spain, Belgium and Germany.

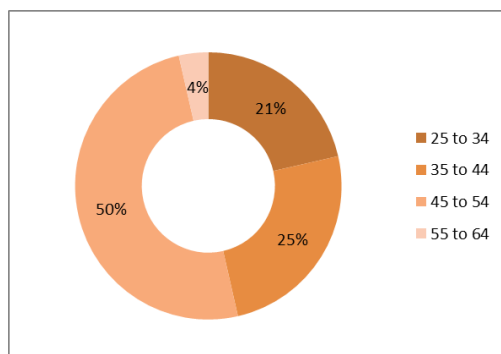


Figure 9: What is your age?

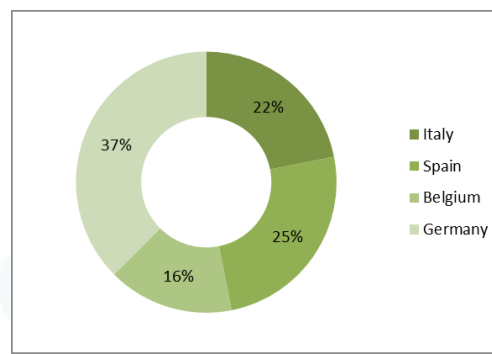


Figure 10: In what country do you live?

The majority of the participants were LEAs (Figure 11) with different roles from the strategical level to the operational and technical ones (e.g. Social network analyst, Analyst, Inspector, Police officer, Technician specialist, Data analyst, Investigator and chief of police, Bavarian Police University - Teacher for operational management, Bavarian Police University - Teacher for assembly and intervention right, Bavarian Office of Criminal Investigations, etc.). Only one private security agent (a coordinator of the stewards at the Olympic Stadium) took part in the validation process.

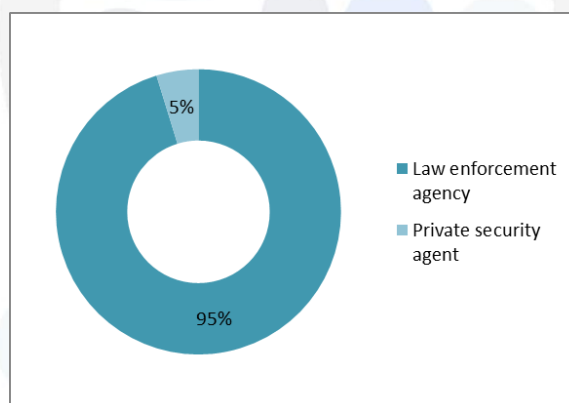


Figure 11: What is your socio - professional category?

Figure 12 shows an overview of the LETSCROWD tools tested during the first cycle of practical demonstrations. For each tool the number of participants involved in the assessment is also indicated. In general, the tools that were tested in more than one PD were assessed by a higher number of participants like SIE, HCV and CMPT. Each technology provider, based on the development status of the tools, decided the number of testing they would need to collect feedback for further improvements and refinements of the tool.

Moreover, as mentioned above a preliminary tentative of integration of the different LETSCROWD outcomes into a unique tool “the LETSCROWD server” was also tested during the PD5 in Munich.

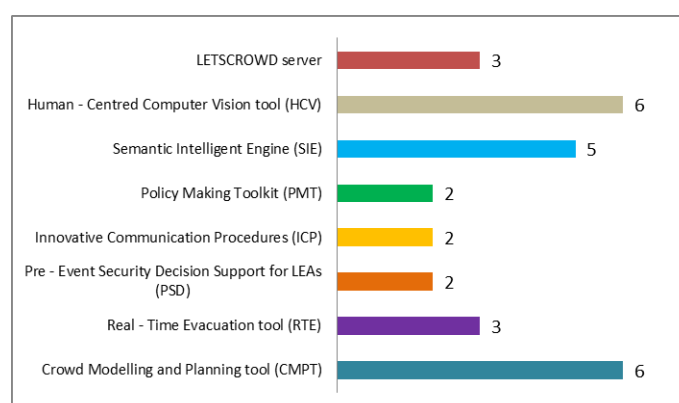


Figure 12: Overview of the LETSCROWD tools assessed and n. of participants involved

As already explained in the previous sections (see 2.5), at the end of each PD, technology providers were asked to administer the validation questionnaire to gather data on the following validation criteria, i.e.: usefulness, usability, compatibility and tools/ software level of maturity.

More than 60% of participants considered the LETSCROWD tools tested very useful (Figure 13), 30% rated the tools as neutral and only one participant reported that the tool tested was not useful. Indeed during the first PD in Bilbao, the semantic intelligence engine was rated as not very useful because it focused on social networks that were not supported by the LEAs tools. Further information could be found in section 4.2.8. Overall, participants involved in this first PD appreciated the first release of the tools. Even though some of them still need to be improved, they seemed to be designed taking into account the presence of a man in the loop, and they were not intended to work in a totally automatic way.

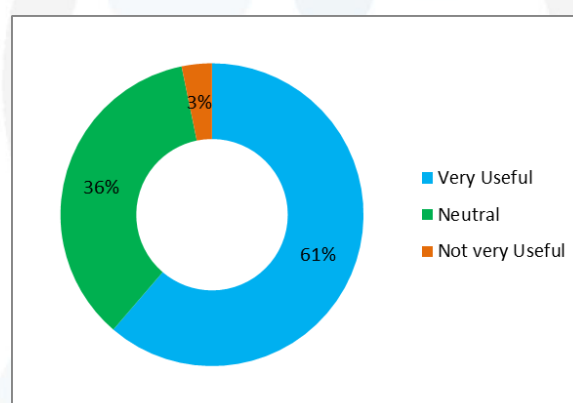


Figure 13: Usefulness: Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

As reported by (9), SUS scores range between 1–100 and 68 is considered the average score. Scores “are affected by the complexity of both the system and the tasks users may to perform before taking the SUS” (10). More information regarding the interpretation of the SUS score are reported in ANNEX B - SUS SCORE INTERPRETATION – section 8.

Figure 14 shows the SUS scores mean values per each tool. Most of the LETSCROWD tools were evaluated above the SUS average; this means that the user’s perception of the usability and comprehensibility of the tools was considered good (9) (see ANNEX B - SUS SCORE INTERPRETATION – section 8). Only the CMPT was scored below the average because it was considered very complex to use without being trained in advance (see section 4.2.1.2.2 for further details).

Also SUS score mean value for the LETSCROWD server was below the general average. Although all the experts agreed that the LETSCROWD server could be helpful only for big events because it supports the collection of information throughout the different phases of an event; some improvements would be required in order to use it properly (see section 4.2.9.2.2).

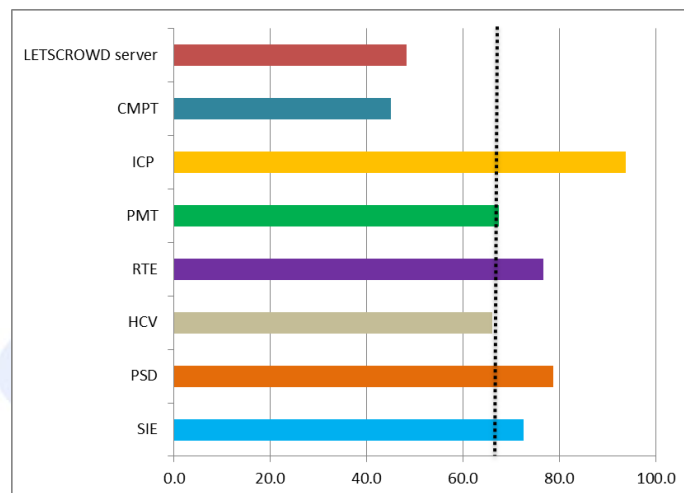


Figure 14: Usability: SUS scores mean values per each tool

Overall the majority of participants thought that LETSCROWD tools were effective and efficient to complete daily working tasks (Figure 15). Only the semantic engine tool was considered not effective because, at the time of the practical demonstration in Bilbao, it did not cover the data sources used by the Spanish police forces (see also Figure 16 and Figure 17).

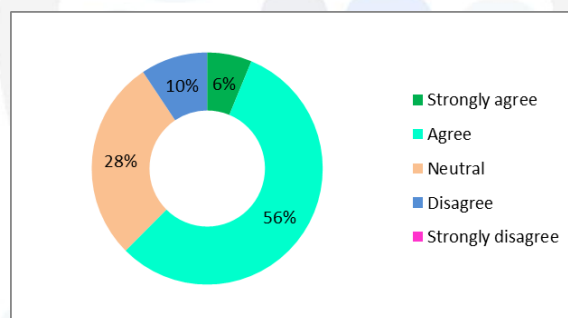


Figure 15: Effectiveness - I can effectively complete my work using this tool

More than 70% of the experts believed that the tools are compatible with the already existing practices and procedures adopted within their organisations (Figure 16) and that the tools might be realistically used and integrated within their organisations (Figure 17).

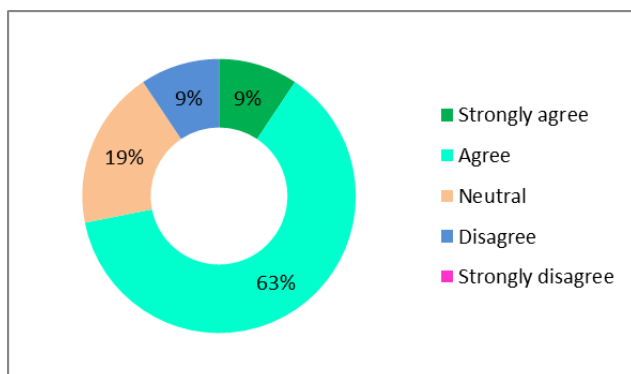


Figure 16: Compatibility - I believe that this tool is compatible with procedures already existing in my organisation

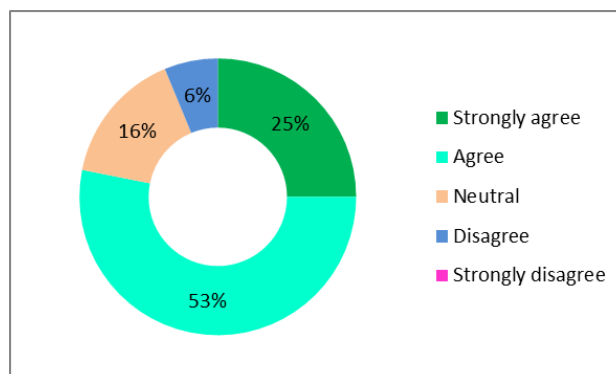


Figure 17: Compatibility - I believe that this tool is realistically applicable in my organisation

Finally, the maturity levels are reported in Figure 18. Most of the tools were rated as TRL 4 or 5 this means that participants considered the main components well integrated and ready to be used in simulated operational or real environments. Some tools like the HCV obtained a TRL 3, however all the experts felt that the tool can achieve a TRL of 5 at the end of the project.

The detailed discussion of the maturity level results per each tool could be found in the following sections.

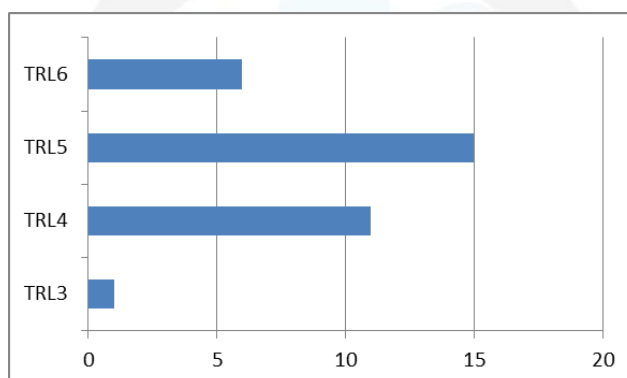


Figure 18: Maturity levels scores

Regarding the requirements validation of the LETSCROWD outcomes, the data collected by means of the requirement acceptance scales have been analysed providing two main types of results:

- Mean value of each requirement for each tool, in order to have a detailed picture of the requirements acceptance from validators;
- Qualitative rationale to explain the provided assessment for each requirement.

Since the requirements number is different among the LETSCROWD outcomes and the number of validators involved differs from tool to tool, the requirement acceptance scales mean values of the different LETSCROWD outcomes cannot be put in relation to each other or compared.

The following sections present the specific results gathered per each tool by detailing the feedback collected through the validation questionnaire, the debriefing template and the requirements acceptance scales. General recommendations for future improvements have been also included.

4.2 SPECIFIC RESULTS PER EACH TOOL

For each tool the following information were reported:

- Short description of the tool and short description of the main objectives of the PDs;
- Description of the validation exercises executed to assess the tools;
- Report of the main results collected through the validation questionnaire, the debriefing sessions and the requirements acceptance scale;
- General recommendations for further improvements.

4.2.1 Crowd modelling and planning tool (CMPT)

The CMPT is essentially a software tool that allows LEAs to plan for crowds at mass gatherings. This can be done before and event or during operations. It uses crowd modelling techniques to model normal behaviour at events, evacuation, crowd management strategies and LEA tactics.

The main components of the CMPT were showed in two practical demonstrations: PD4 (Malle) and PD5 (Munich). The aim of the PDs was twofold:

- 1) to obtain LEAs' feedback on the tool and its usability and to use the tool on a real event (PD4 Malle).
- 2) to compare the simulation results with the movement of the volunteers to be able to (PD5 Munich):
 - demonstrate how the simulation compares to the crowd behaviour during the demo;
 - calibrate the parameters of the simulation in the future.

Three police officers from LPV and three from the Bavarian police were involved in the validation sessions.

The detailed descriptions of the validation exercises carried out during the practical demonstration are described in section 7, while the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.1.2, 4.2.1.3 and 4.2.1.4.

4.2.1.1 Description of the validation exercises in PD4 Malle and PD5 Munich

The following tables report the details of the validation exercises carried out to assess the first release of the crowd modelling and planning tool.

Table 8: CMPT – PD4 description of the validation exercise

SHORT DESCRIPTION OF THE TOOL AND THE MAIN COMPONENTS ASSESSED	All components of the tool currently developed were demonstrated. Scenarios were tested as suggested by the operator of LEA members. Simulations were set up on the first day of the demonstration after a site tour, and some analysis was undertaken. This was amended throughout the demonstration after observing crowd behaviour on the CCTV. We also considered the evacuation of the event, and testing different widths of escape route around the complex network of the event.
DESCRIPTION OF THE VALIDATION TEAM	A single member of CROWD held the validation workshops and demonstrated the tool at the event.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	Three experts from LPV were involved in the PD with the following roles: <ul style="list-style-type: none"> • Chief of Police • Interface Officer • Investigator

TYPE OF EXERCISE ⁴	A full scale exercise was undertaken with the CMPT as the analysis was undertaken on a real event. However, no operational decisions were allowed to be made based on results of the tool. The exercise was played out in the control room, with scenarios being tested amongst a small workgroup.
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	CROWD operated the CMPT as it is too complex for a LEA to use without training, which was not possible during this PD. The validation team were asked their view during the exercise (2 hours) and then a formal workshop was held to explain and assist in filling out validation questionnaires, a debrief session was held to discuss (2 hours).
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	The explanation of the tool was carried out as the demonstration progressed, no training could be given before the demonstration.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	A camera focused on the main crowd areas failed, but this did not directly impact the CMPT demonstration.
OTHERS GENERAL NOTES AND COMMENTS REGARDING THE EXECUTION OF THE PD	Excellent feedback was gained that could improve the tool.

Table 9: CMPT – PD5 description of the validation exercise

SHORT DESCRIPTION OF THE TOOL AND THE MAIN COMPONENTS ASSESSED	The main components assessed related to social forces and tactic models, but a network evacuation was shown as well (this scenario could not be played out using volunteers and was based on estimated data). The results were compared against the actual results recorded during the volunteer exercises.
DESCRIPTION OF THE VALIDATION TEAM	Two members of CROWD were present to help demonstrate the tool, take notes and answer questions. One, a software developer, the other a crowd simulation and behaviour expert.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	Multiple police officers were present during the demonstration: <ul style="list-style-type: none"> • 1 Teacher for Operational Management • 1 Teacher for Assembly and Intervention • 1 Bavarian State Criminal Institute - Video Surveillance
TYPE OF EXERCISE	The exercises consisted of testing the functionality of the CMPT, but also a focus group to demonstrate the functions and comparison between the actual real behaviour during the demo and the previously simulated one.
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	Multiple small exercises were carried out with a set of volunteers to test: <ul style="list-style-type: none"> - Evacuation - Evacuation with routes closed - Bomb/suspect package behaviour This was simulated in advance before the volunteer exercises. was discussed/presented in a small workgroup to show various functionality

⁴ WK/ FG - Workshops/ focus groups, TFX - Technical and functional exercises, TTX – Table Top Exercise, FSX - Full-scale exercises. For a detailed description of the different exercises see D6.2 - ANNEX A.

PREPARATORY TRAINING ACTIVITIES, n/a
IF CARRIED OUT

CRITICAL ISSUES ARISEN DURING THE n/a
EXERCISE

4.2.1.2 Validation questionnaire results

The following sections will report the main results collected during the three PDs. After the execution of each validation exercises described in section 4.2.1.1, participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

It should be noted that during PDs the police officers did not use the tool themselves as it would not be possible to train them in time.

4.2.1.2.1 Usefulness

In general, the tool was considered very useful for modelling and planning for crowds at mass gatherings before and during a given event (Figure 19). Some officers felt that the tool has very good potential if the use can be simplified and can be integrated with other components. Some experts thought that the tool would be very useful for mobility assessment.

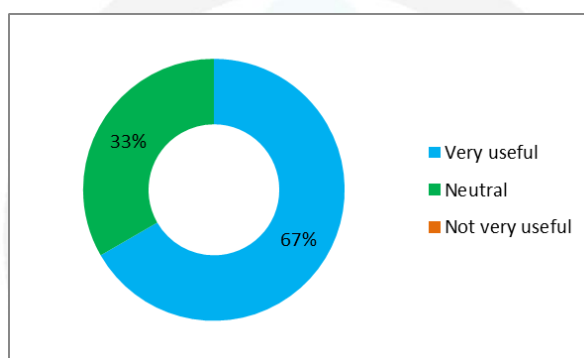


Figure 19: CMPT usefulness - Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

The following features of the tool were considered the most important by the LEAs:

- the evacuation tool because it would be used more frequently than the others and showed an easy to understand output;
- Counting the number of police officers (or dogs) which could help to plan the operations - either before and event or during;
- The simulation of people entering the event is also useful because the police could compare what was planned to happen with what is actually happening by watching CCTV;
- Visualisation of scenarios testing in planning stage;
- Counting crowd in real time and running different what-ifs scenarios and do-nothing scenario.

While the simulation of behaviour for a bomb is considered very interesting, but was chosen as least important as it would not be used as much as the other features (as the hope is a bomb is much less likely to happen, but normal movement and how to evacuate in general could be used a lot).

4.2.1.2.2 Usability

The SUS score mean value for the CMPT was 45.0, below the general average of the scale. The main reason for the low score was due to the impossibility to properly train the police officers before the execution of the demonstrations. For this reason the CMPT was operated by the technology provider as it would be too complex for a LEA to use without training.

Individual SUS scores are reported in the figure below.

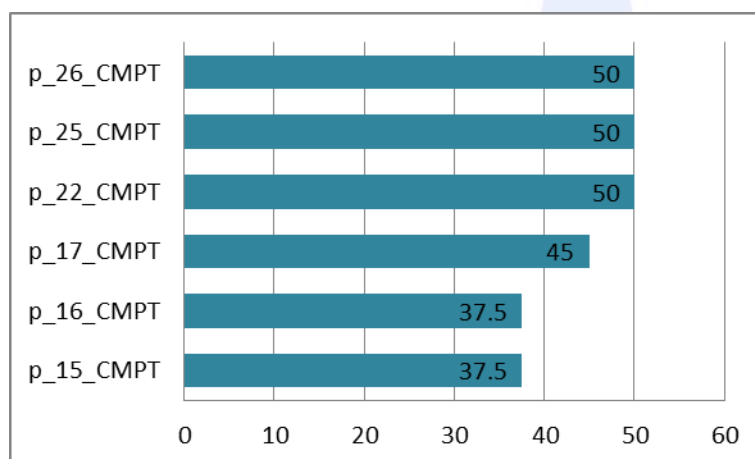


Figure 20: CMPT Individual SUS scores

Although the participants thought that the tool could be frequently used at most mass gatherings/events, it seemed not very easy to learn because of the requirement to understand crowd modelling input/outputs.

All the police officers agreed that they would require a training period before being able to use the tool themselves. All the LEAs thought that an operator would probably need to go on training and learn how to use the software (which buttons to press, how to navigate etc.) and to understand the principles of crowd modelling (e.g. how to decide which model to use, which scenarios to test and how to interpret the results is important to prevent misunderstanding).

At the current state of development the tool seemed really complex and not easy to use. Some officers stated that the user interface should be simplified to usable in operational environments (see general recommendations 4.2.1.4).

4.2.1.2.3 Effectiveness and Compatibility

All participants agreed that with proper training the CMPT will help to understand the crowds at a mass gathering. Most of the experts thought that this is something that is new and they do not already use any simulations, but if they wanted to, they feel CMPT would allow them to do so effectively (see Figure 21: CMPT effectiveness scores - I can effectively complete my work using this tool).

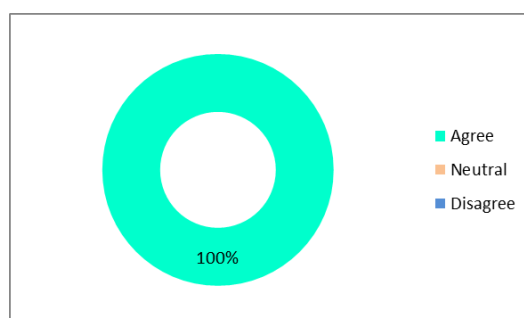


Figure 21: CMPT effectiveness scores - I can effectively complete my work using this tool

Even if the tool would need to be integrated with already existing software, participants stated that the use of the tool would not contradict any current procedures and practices (see Figure 22).

Finally, all participants agreed that, after a proper training, the CMPT would be applicable in real situations particularly during pre-planning, operations and briefing and debriefing phases of a mass gathering (see Figure 23).

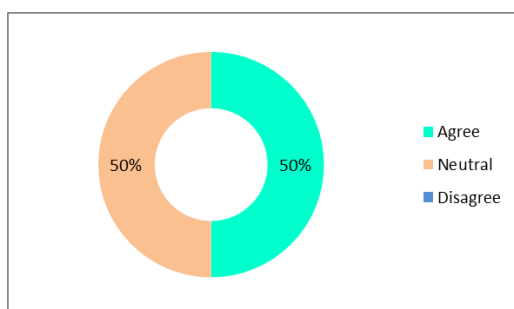


Figure 22: CMPT compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

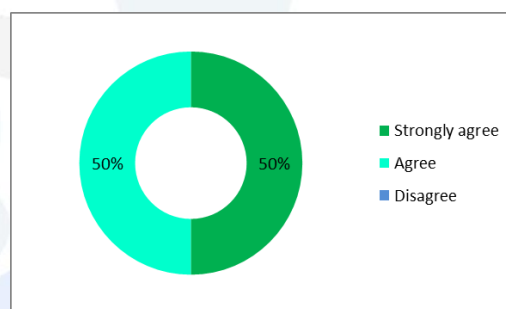


Figure 23: CMPT compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.1.2.4 Maturity

The figure below shows the CMPT maturity level scores. Participants rated the tool between TRL 4 and 5, this means that the main components of the tools are well integrated; the tool seems likely ready to be used in operational environment. Nevertheless, some LEAs suggested that some further improvements are needed to be adopted in operational situations (e.g. the tool should be integrated with camera counting technology to make input of visitor numbers easier).

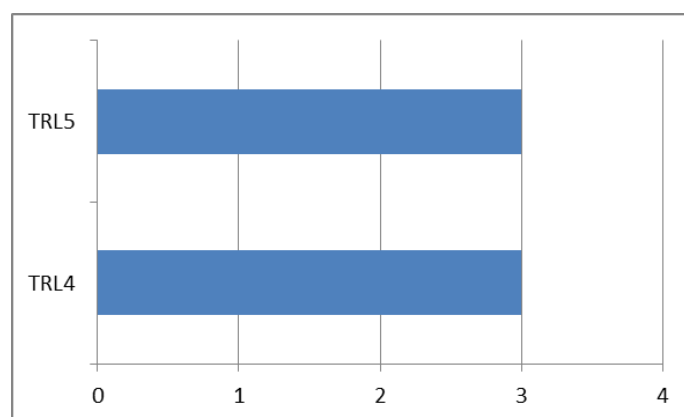


Figure 24: CMPT maturity level

4.2.1.3 Requirements acceptance scales results

The CMPT requirements have not been updated with respect to those included in the deliverable D2.1 *Project Requirements definition*. Both in the PD4-Malle and PD5-Munich, requirements were discussed during the final debriefing during which a CROWD representative filled out the requirement acceptance scale on behalf of, respectively, the three members of the LPV LEA validation team, and three LEA officers involved in Munich in the CMPT requirements validation. After the practical demonstrations, LEAs reviewed the requirement acceptance scales to check their consistency and confirm that they were representative of the LEAs' assessments. In total five LEAs experts were involved in the requirements validation.

An overview of the requirements level of acceptance is shown in the Figure 25.

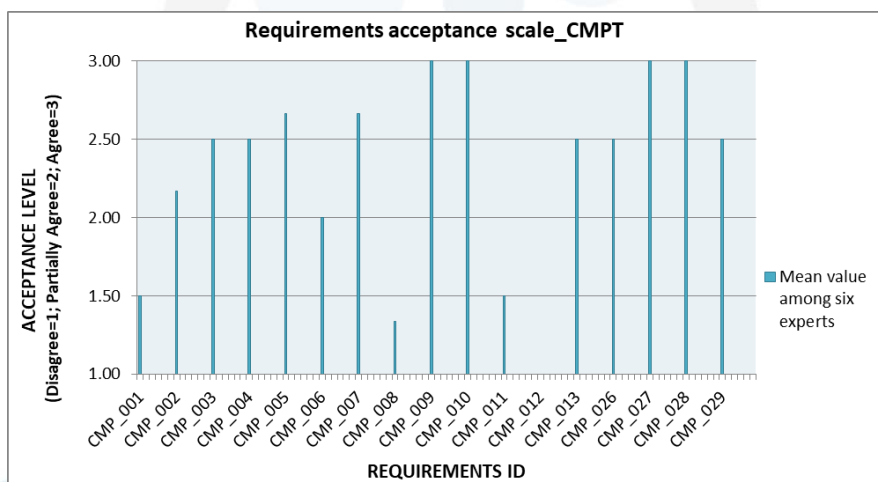


Figure 25: CMPT – Requirements assessment scale results

In the Table 10 a qualitative rationale for the assessment given to each CMPT requirement is provided. Also the type of validator (i.e. LEA expert or Technology provider) is specified (see section 2.4.3). The requirement level of acceptance corresponds to the mean value - among the five experts involved - of each requirement.

Table 10: CMPT – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
CMP_001 The tool will have a user-friendly, intuitive Graphical User Interface.	LEA expert	1,50	The interface was considered as quite complex and not friendly for an officer who is not familiar with the tool. It should be simplified.
CMP_002 The tool will allow users to input event parameters.	LEA expert	2,17	The tool allows the input of many parameters (e.g. location, number of people, where people can move, etc.) but in a complex way.
CMP_003 The tool will have a GIS-based system.	LEA expert	2,50	This functionality has been validated navigating events. The tool uses GIS for its maps and display.
CMP_004 The tool will have a user interface to simulate crowds.	LEA expert	2,50	The user interface allows users to set up and simulate crowds.
CMP_005 The tool will be able to visualise crowd model results (3D).	LEA expert	2,67	The crowd can be rendered in 3D.
CMP_006 The Crowd Model will be based on empirical data where possible.	LEA expert	2	The CMPT simulation bases on known crowd models and on empirical data collected in scientific studies. No other empirical data have been used.
CMP_007 The Crowd Model will be usable in pre-planning and operational event phases by LEAs.	LEA expert	2,67	CMPT can be used to test future plans, to plan crowd control, assess a current situation and, possibly, even for the post-event debriefing.
CMP_008 The tool should have methods for pushing/pulling real-time data. All tools should have a common method for geolocation and timestamp, which must be trustable.	LEA expert	1,33	The low value is due to the fact that this functionality has not been tested in PD4. In the PD5, it was validated in relation to the CMPT integration in the LETSROWD server. Concerning this, it was assumed that the tool could receive and output data for other tools.
CMP_009 The tool will be able to predict a normal crowd behaviour, to set a benchmark for normality in a dynamic situation.	LEA expert	3	The tool can model normal crowd behaviours. In both the PDs, the tool was able to predict the ingress of people to the event and different movements around the event.
CMP_010 The tool should model crowd behaviour in reaction to an incident, such as terrorist or LEA tactic.	LEA expert	3	The tool can model these scenarios. For example, in the PD4, it was simulated how police officers behaviour (e.g. their positioning in the event venue; number of police officers, etc.) can influence crowd behaviour and, also, how crowd reacts to a bomb.
CMP_011 The tool will allow input/output of Static and Dynamic Risk	LEA expert	1,50	This functionality was not tested in PDs, but some experts involved in the PD5 evaluated that CMPT could be able to output data that can be put into

Assessment.			Dynamic Risk Assessment.
CMP_012 The tool should be linked with outputs from image processing, to gather real-time crowd densities, crowd behaviour and detected movement of groups within a crowd.	LEA expert	1	This functionality was not tested in PDs because the tool is not yet integrated. However, the tool will, in the future, get the outputs from the image processing.
CMP_013 The dynamic crowd model will model complex crowd behaviours.	LEA expert	2,50	CMPT allows to model different crowd behaviours.
CMP_026 The tool will have a scrollable timeline for events.	LEA expert	2,50	The tool has a timeline available in the software when planning events and simulations.
CMP_027 The tool will provide the possibility to upload (a drawing of) a ground plan.	LEA expert	3	Any image, including ground plans, can be uploaded and then scaled and manipulated as needed.
CMP_028 The tool will be first in English, and then translated into other languages after it is reliable.	LEA expert	3	The tool is in English.
CMP_029 The tool can store certain places/venues where regularly happens an event so that some data is entered automatically.	LEA expert	2,50	Bookmarks of locations can be saved and stored in the software. They can be quickly brought up again in the future.

4.2.1.4 General recommendations

Based on the feedback gathered from the experts involved in the PDs some general recommendations can be derived. The suggestions can be used for enhancing some functionalities of the CMPT.

The main indications collected can be synthesized as follows:

- Simplify the user interface:
 - Clear all unused functions from the screen;
 - Don't have separate files for different scenarios;
 - Make results available without save and load;
 - Make a simple choice (for example, put in the number of people in different areas or read from computer vision).
- Tactic simulation would need further research as crowd reaction could be different on event type and demographic of crowd for the input parameters:
 - Walk speed (normal/flee/emergency);
 - Police force;
 - Dog force.

- Train the users in order to be able to properly use the tool.
- Some officers felt that the tool has very good potential if the use can be simplified and can be integrated with other components and tools such as the crowd counting so that less manual input would be required.
- Printable report of a setup would be useful to review parameters like size and location of elements added to scene.

4.2.2 Dynamic risk assessment (DRA)

According to project's plans, DRA will be validated only in the second round of PDs. Therefore, this section reports how far the LETSCROWD technologies can support the DRA scenario described in D3.6 that will be tested in the second PD validation cycle.

The evaluation is mostly based on the LEA's debriefing reports and will be consolidated after the second PD validation cycle.

Table 11 - DRA-oriented evaluation of LETSCROWD technologies

LETSCROWD Technology	Evaluation
CMPT	The CMPT can potentially be used by the DRA only for early planning, by using its output as predefined information on evacuation risks. The first round of PDs has confirmed its potentialities.
HCV	<p>As already stated in D3.6, the HCV can be used by DRA for the following aspects:</p> <ul style="list-style-type: none"> • Detection of suspicious vehicles/persons and generation of specific weak signals; • Person re-identification; • Estimate the crowd density and evaluate potential consequences in case of potential threats. <p>The LEA's debriefing reports after PD in Munich have evaluated only the crowd density estimation and the person re-identification tools. From their feedback emerges the following:</p> <ul style="list-style-type: none"> • There is a great interest for the crowd density estimation. However, its accuracy can be an issue in specific settings. For instance, when the crowd size is near to the capacity of the venue a very high accuracy is required to avoid, e.g., that an overcrowding gets undetected. • Image-based person re-identification is felt to be the least important feature, since its accuracy can be low in mass gathering events. <p>All the above allows to draw the following DRA-related conclusions:</p> <ul style="list-style-type: none"> • Detection of suspicious vehicles/persons has not yet been tested and therefore no conclusions on its effectiveness for DRA can be drawn, it is clear that its role for DRA can be of extreme importance • The crowd density estimation could be effectively used during mass gathering

	events to replace human operator to calculate the consequences of a threat during DRA.
SIE	<p>The Semantic Intelligence Engine (SIE) can play an extremely important role in dynamically assess the risk for the crowd by generating weak signal to be processed and correlated by DRA.</p> <p>Further dedicated tests are required in the second stage of PD validation to confirm the positive validation of the first stage of PD by the LEAs.</p>
LETSCROWD Server	The LETSCROWD server is the system in which DRA will be integrated and will only be demonstrated in the second stage of PD validation. However it is possible to anticipate that the current version of the tool is designed to host the DRA exploiting its full potentialities.

4.2.3 Human-centred computer vision tool (HCV)

The HCV tool is a prototype of two kinds of computer vision functionalities aimed at supporting LEA operators in the use of video surveillance systems for crowd monitoring during mass gathering events:

- monitoring a crowd, including real-time crowd density estimation (the only functionality implemented for the first PD cycle), detecting patterns of crowd movements, detecting anomalous crowd behaviours;
- searching for individuals of interest on recorded videos (forensic investigation scenarios), and potentially on streaming (live) videos, based on clothing appearance: image-based person re-identification and attribute-based people search.

The main functionalities of the HCV were tested in three different practical demonstrations with the following purposes:

- PD1 – Bilbao: the main aim of this PD was to carry out a first test of the HCV tool, giving the involved LEA a concrete example of the available functionalities, and getting LEA's feedback on the potential usefulness of the above functionalities in its operations;
- PD4 – Malle: the second validation in Malle aimed to test the HCV tool in a real mass gathering event, showing LPV officers its functionalities and getting feedback about its potential usefulness and expected accuracy, and suggestions for improvement;
- PD5 – Munich: the third validation aimed test the HCV tool in small-crowd scenes simulated by volunteers (Bavarian Police University students), showing BayHfoeD officers its functionalities and getting feedback about its potential usefulness and expected accuracy, and suggestions for improvement.

The table below synthetises the main functionalities tested in the three practical demonstrations.

PD1 - Bilbao	The version of the HCV tool tested in the first PD was made up of two components: crowd density estimation and image-based person re-identification.
PD4 - Malle	The version of the HCV tool tested in this PD was made up of three components: crowd density estimation, image-based person re-identification, attribute-based

	people search.
PD5 - Munich	The version of the HCV tool tested in this PD was made up of three components: crowd density estimation, image-based person re-identification, attribute-based people search.

A total of six participants were involved in the assessment of the HCV as follows:

- PD1 – Bilbao: One officer from ERT, an IT specialist technician who is in charge of supervising and monitoring the video surveillance systems at ERT headquarters.
- PD4 – Malle: two police officers from LPV.
- PD5 – Munich: Two officers from Bavarian Police University – one is teacher for operational management, the other for assembly and intervention right; a third officer from Bavarian State Criminal Investigations – member of the project group “video surveillance”.

The detailed descriptions of the validation exercises carried out during the practical demonstrations are described in the following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.3.2, 4.2.3.3 and 4.2.3.4.

4.2.3.1 Description of the validation exercises in PD1 Bilbao, PD4 Malle Cycle-cross and PD5 Munich

The following tables report the details of the validation exercises carried out to assess the first release of the Human Computer Vision tools.

Table 12: HCV – PD1 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed by a researcher from UNICA (T5.4 responsible) who organized the PD and collected the validation results.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	One officer from ERT, an IT specialist technician who is in charge of supervising and monitoring the video surveillance systems at ERT headquarters.
TYPE OF EXERCISE	TFX - Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>The ERT officer was asked to use the HCV tool on previously recorded, publicly available videos, and possibly on the videos being recorded during the event, with the support of the technology provider, and to discuss the different aspects of the available functionalities (e.g., their potential usefulness in the context of the monitoring tasks carried out by ETRA).</p> <p>In practice, due to a problem with the graphical interface (see critical issues described below) the tool was directly used only by the technical provider, and shown to the ERT officer.</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	A brief demonstration of the two components of the HCV tool was given to the ERT officer by the technology provider, using previously recorded, publicly available videos.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	The HCV tool was provided as a virtual machine which was installed at the beginning of the practical demonstration into a computer provided by ERT, as agreed in advance to avoid sending outside ERT IT facility any video

recorded during the event. However, the graphical user interface of the virtual machine exhibited technical problems which made it not possible to the ERT officer to properly evaluate the HCV tool during the practical demonstration.

Additionally, videos recorded during the event were not available within the end of the PD, and therefore only previously recorded, publicly available videos were used.

Table 13: HCV – PD4 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	<ul style="list-style-type: none"> Three researchers from UNICA: the T5.4 responsible, who led the PD of the HCV tool and acted as moderator and note taker; a PhD student and a research fellow, developers of the HCV tool, who managed the technical aspects of the PD CROWD's associate director, who acted as moderator
PARTICIPANTS (ROLES AND RESPONSIBILITY).	Three officers of the Lokale Politie Voorkempen tested the tool, and two of them were involved in the validation procedure: an investigator and an interface officer.
TYPE OF EXERCISE	TFX - Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	Four PTZ video cameras were installed in different points of the event venue by the Belgian Federal Police specifically for this PD, since the use of a CCTV system was not planned for this event; the cameras were controlled by three operators of the Federal Police in a command post, through the same CCTV software suite used in real operations. The camera views were set with the support of UNICA team. Different videos were recorded during the event; five volunteers recruited by LPV were included in some videos, to test the person re-identification and people search components. Recorded videos were then used to test the three components of the HCV tool by the LPV officers involved.
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	The functionalities and the use of the HCV tool were briefly illustrated to three LPV officers involved in the test by the UNICA T5.4 responsible, using some of the videos previously recorded.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	None.

Table 14: HCV – PD5 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	<ul style="list-style-type: none"> Three researchers from UNICA: the T5.4 responsible, who led the PD of the HCV tool and acted as moderator and note taker; a PhD student and a research fellow, developers of the HCV tool, who managed the technical aspects of the PD Two members from ETRA (project coordinator) and CROWD (Win Thi Ha, Alexander Elms), who acted as moderators
PARTICIPANTS (ROLES AND RESPONSIBILITY)	Two officers from Bavarian Police University – one is teacher for operational

RESPONSIBILITY).	management, the other for assembly and intervention right; a third officer from Bavarian State Criminal Institute – member of the project group “video surveillance”
TYPE OF EXERCISE	TFX - Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Several simulated small-crowd scenes with about 60 volunteers (Bavarian Police University students) were agreed and planned in advance by BayHfoeD responsible and the technology providers, in three locations of the venue (two outdoor locations, a courtyard and a car parking; and an indoor location, a lecture hall).</p> <p>Several video cameras by BayHfoeD and by the technology providers were used to record the scenes.</p> <p>Recorded videos were then used to test the three components of the HCV tool by the LPV officers involved.</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	The functionalities and the use of the HCV tool were briefly illustrated to the officers involved in the test by the UNICA T5.4 responsible, using some of the videos previously recorded.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	None.

4.2.3.2 Validation questionnaire results

The following sections will report the main results collected during the three PDs. After the execution of each validation exercise (see previous paragraph), participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.3.2.1 Usefulness

The majority of the experts rated the tool as neutral. To interpret the meaning of this rating some notes and explanations from the debriefing session have been synthesized as follows:

- During the first PD in Bilbao the police officer from Ertzaintza was not able to properly evaluate the HCV tool due to a problem with the graphical interface. The HCV tool was provided in a virtual machine which was installed at the beginning of the practical demonstration into a computer provided by Ertzaintza, as agreed in advance to avoid sending outside Ertzaintza IT facility any video acquired during the event. However the graphical user interface of the virtual machine exhibited technical problems. It has only been possible to describe the functionality of the tool to the Ertzaintza officer, and to show him a demo of its working using a publicly available video.
- As reported by the LPV officers, the tool could be very useful, but to be effective in a real operational scenario the accuracy of its components should be higher. In particular, the image-based person re-identification and attribute-based people search components provided too many false positives, i.e., too many images of different people than the ones searched for.
- Even if the HCV tool appear useful for the operations of the Bavarian Police; regulations in Bavaria about video surveillance systems may restrict the use of the person re-identification and people search components only in a forensic investigation scenario for ex post analyses, for crime

prosecution/investigation. Such restrictions do not apply to the crowd monitoring component (crowd density estimation, and crowd anomalous behaviours detection).

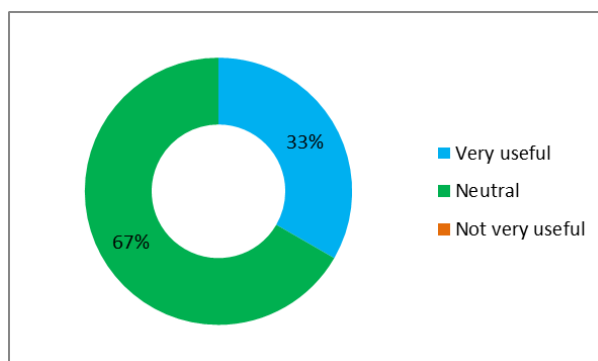


Figure 26: Usefulness HCV - Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

The table below shows the different opinions collected regarding the most and the least important features of the HCV tool.

LEAS	THE MOST IMPORTANT FEATURES	THE LEAST IMPORTANT FEATURES
Ertzaintza police	The most important feature is the appearance-based person re-identification functionality, if it can be used in real-time during event execution. The reason is that Ertzaintza operators often need to track in real time suspect individuals seen in videos coming from their cameras to support their monitoring and decision-making activity during mass gathering events. Currently this task is carried out manually by directly looking at streaming videos.	Appearance-based person re-identification, if used offline, e.g., for analyzing recorded videos in post-event investigations. The reason is that such an activity is usually not carried out in the context of events like concerts and football matches, where real-time monitoring tasks are more important.
Lokale Politie Voorkempen	Image-based person re-identification seems the most important feature: in real mass gathering events it would be useful to be able to search for suspect individuals starting from an image of them, in the videos acquired by a CCTV system.	Among the three features tested, the crowd density estimation seems the least important one, since it would not be used frequently in mass gathering events managed by LPV.
Bavarian Police	Crowd density estimation appears the most useful feature. Currently this kind of information is provided by operators in the field.	The Image-based person re-identification is felt to be the least important feature by the Bavarian police, since its accuracy can be low in mass gathering events where many people are likely to wear similar clothing (for instance, the supporters of popular football teams during a match). In this case the search for a specific individual based on clothing appearance may produce many false positive results.

4.2.3.2.2 Usability

The SUS score mean value is 65.0, slightly below the general average of SUS scale. SUS individual scores are reported in the figure below.

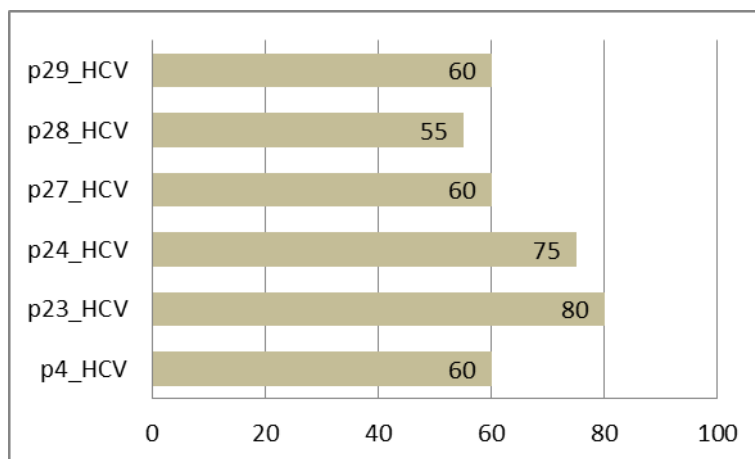


Figure 27: HCV - Individual SUS scores

In general, all the experts agreed that the tool could be used frequently, as it provides some useful features to support police officers in monitoring and decision-making activities during mass gathering events.

The police officers from LPV who directly tested the tool found it easy to use, after a minimal training. All the three components required simple and intuitive operations through a graphical user interface.

Although, the HCV tool was not directly used by the Bavarian officers involved in the PD5, due to limited time, the tool was considered easy to use and to learn. As pointed out by the Bavarian police officers, *“to make users confident it is important to make them aware of how a tool works and of the possible mistakes, it could make to enable them to correctly understand and interpret its outputs. For instance, users of the HCV tool should be aware of the degree of accuracy of the estimated crowd density under different possible scenarios, for instance under good or poor lighting conditions.*

The three components (image-based person re-identification, attribute-based people search, and crowd density estimation) appear well integrated, under the same graphical user interface. The experts from LPV explained that *“in this prototype version the main components can be accessed through a common web-based interface (through a web browser), and each of them has a very similar interface.*

4.2.3.2.3 Effectiveness and Compatibility

Regarding the effectiveness of the tool in supporting police officers in fulfil their tasks and activities, the majority of the experts involved in the assessment rated the tool as neutral (Figure 28) for the following reasons:

- PD4. The police officers from LPV rated the tool as neutral since in its current version the three components are not accurate enough for real operational scenario. *“If their accuracy will be improved, they have potential to become effective tools for LPV work”.*
- PD5. Two out of three police officers from Bavarian police rated the tool as neutral since the officers who validated the tool were members of a Police Officers School and they were not directly involved in CCTV-related monitoring tasks during mass gathering events. Anyway, they underlined that the tool could be a valuable add-on for officers and operators directly involved in those tasks.

Although the HCV could not be properly tested during the first PD in Bilbao, its functionalities appeared potentially capable to improve the effectiveness of Ertzaintza operators in monitoring and decision-making activities during mass gathering events as they provide support in tasks currently carried out manually.

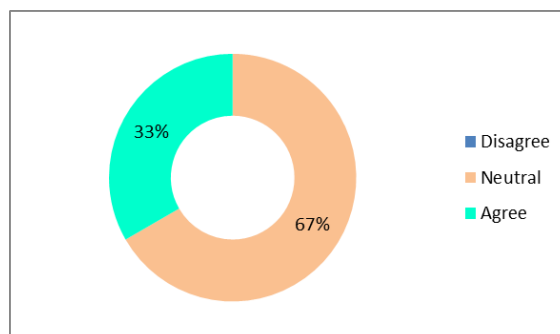


Figure 28: HCV effectiveness scores - I can effectively complete my work using this tool

Not all the participants felt the tool to be compatible with existing practices and procedures. As mentioned above, for the Bavarian police the use of the person re-identification and people search features would be restricted by existing regulations only to investigations about specific crimes. However they also mentioned that the tool offers additional features to existing CCTV systems, which in general look compatible with procedures and practices used by the Bavarian Police.

The majority of the experts believed that the tool would be applicable in realistic situations, but as pointed out by the LPV officers a higher accuracy of some of the functionalities would be required for using them in real operational scenarios.

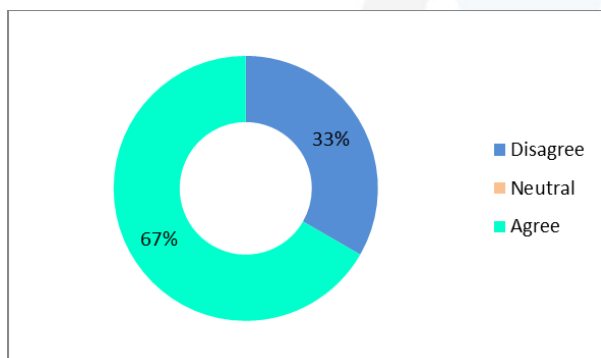


Figure 29: HCV compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

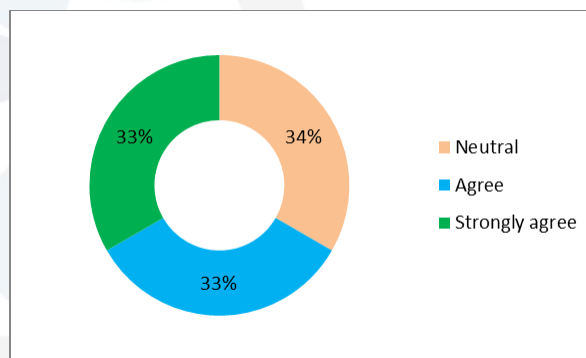


Figure 30: HCV ICP compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.3.2.4 Maturity

The figure below shows the HCV maturity levels scores. The majority of the participants rated the tool between TRL 3 and 4, however all the experts felt that the tool can achieve a TRL of 5 at the end of the project.

Given that during the first PD the tool could not be properly assessed, it was not possible for the participant to evaluate its TRL is higher than 3. While, even if the police officers from LPV rated the tool as TRL 5 because all the components of the tool appear well integrated, and they were actually tested in a simulated

operational environment during the cyclocross race⁵; the accuracy of the main features of the HCV should be improved to be used in real operational environments.

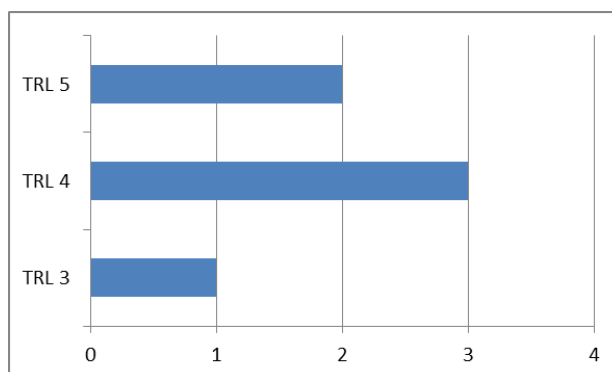


Figure 31: HCV maturity level scores

4.2.3.3 Requirements acceptance scales

The HCV requirements have not been updated with respect to D2.1. They were validated in PD1, PD4 and PD5 by involving respectively: one police officer from Ertzaintza; two officers of the Lokale Politie Voorkempen and three officers from the Bavarian police.

In all the PDs, HCV requirements have been assessed through specific test cases defined by UNICA for each PD, by adapting the requirements acceptance scale. A detailed description of the three test cases carried out is reported in section 10 - ANNEX D. In PD4 and PD5, the HCV tool was used by LEA operators to support them in two tasks: (i) *crowd monitoring* during event execution, to estimate the density of the crowd from videos; (ii) analyzing recorded videos in a post-event forensic investigation involving the search for a specific individual of interest, either seen by an operator in one video (*image-based person re-identification*), or described by an eyewitness, including LEA operators in the field (*attribute-based people search*). In the PD1 the attribute-based people search was not tested.

Some of the HCV requirements were validated from the user' perspective, while others from the technology provider point of view. In PD1, a problem with the HCV graphical interface (see critical issues described in section 4.2.3.1) did not allow the LEA expert to directly use the tool. It was used only by the technical provider and shown to the ERT officer.

The majority of the requirements refer to general HCV features that are shared among the three tools/ functionalities included in HCV, i.e.: crowd monitoring, image-based person re-identification and attribute-based people search. Others specifically address each tool, as shown in the table below. For each requirement, the Table 15 includes the description, the type of validator, the level of acceptance (i.e. the mean value among the six LEA experts involved) and the qualitative rationale behind the assessment provided.

⁵ Videos used in the test were acquired on a real mass gathering event by a CCTV system provided by the Belgian Federal Police only for the purpose of this practical demonstration, and included volunteers (actors) to simulate individuals of interest for the person re-identification and people search tools.

Table 15: HCV – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
GENERAL REQUIREMENTS			
HCV_002 The tool shall be compliant with EU privacy regulations and with any other regulations of the use of video-surveillance systems by the LEAs, including related LEAs internal procedures.	LEA expert	3	The HCV tool provides features that would be added to CCTV systems already used by Basque, Belgian and Bavarian LEAs to monitor mass gathering events. Estimating the number of people in a crowd is compatible with existing procedures and practices. Searching for suspect individuals is also compatible, but existing regulations – for instance in Bavaria - restrict it only to forensic investigations (ex post analyses) for crime prosecution/investigation. These functionalities provided by the HCV tool that are related to monitoring tasks are currently manually carried out by Ertzaintza and Bavarian operators. For the purpose of the PD4 (Malle), HCV was tested in a computer provided by UNICA, from which all the videos have been deleted at the end of the test to avoid any issue with existing regulations..
HCV_003 The tool will be designed and evaluated using data sets (images and videos) collected for research purposes and publicly available.	Technology provider	3	Publicly available data sets (among the ones mentioned in deliverable D5.4) have been used to design the HCV tool. Two of them were made available to the LEAs officers involved in the practical demonstrations for training. However, in the PD1, there was no need to use them since videos acquired during the events were used to show the HCV functionalities to LEAs officers.
HCV_005 The tool shall exploit feedback from LEA operators to improve its effectiveness over time.	Technology provider	1	This functionality is currently under implementation and is not available yet.
HCV_006 The tool must be user-friendly: it should provide a simple and intuitive graphical user interface and should be easy and fast to use.	LEA expert	2,67	In the PD1, it was not possible to validate this requirement since the HCV tool could not be properly assessed by the Ertzaintza officer. In the PD4, it took just a few minutes to show the LEA officers how the tool works. They were then able to test the tool autonomously. In the PD5, there has been not enough time to let the involved LEA officers to use the tool, but they found it easy to understand, and felt it would be easy to use with a minimal training.
HCV_009 The tool will be first in English, and then translated into other languages after it's reliable.	LEA expert	3	The whole user interface is in English.
HCV_014 The tool should be designed using videos acquired by video-surveillance systems	Technology provider	3	Simulated videos have been provided by Crowd Dynamics during the development phase of the crowd density estimation functionality, to

during relevant, real or simulated mass gathering events.			complement the publicly available (scarce) annotated videos for training the underlying machine learning algorithms. Some of the videos acquired in the PD4 and all the videos acquired during the PD5 are available to UNICA for improving the HCV tool, only for the purposes of this project.
HCV_015 The tool shall provide a web-based graphical interface for each functionality.	LEA expert	2,67	In the PD1, it was not possible to validate this requirement since the HCV tool could not be properly assessed by the Ertzaintza officer. This requirement have been validated in PD4 and PD5 where it was verified tha the tool is accessible through a web-based interface (i.e., through a web browser).
CROWD MONITORING			
HCV_007 The crowd monitoring tool will process videos acquired by standard, fixed or PTZ, video surveillance colour cameras. Tilt angle with horizontal plane: about 45 degrees or more; height: about 5 m or more.	Technology provider	2,83	Both publicly available videos and simulated videos provided by Crowd Dynamics, exhibiting the required characteristics, have been used during the HCV tool design. No videos acquired during the PD1 were available within the end of the practical demonstration. In PD4, the crowd density estimation functionality was tested on videos acquired during the PD from four PTZ colour cameras provided by the Belgian Federal Police, placed at about 3 to 5 m height, with varying tilt angle with the horizontal plane, including about -45 degrees. In the PD5 the same functionality was tested on videos acquired during the Pd from a fixed colour camera provided by UNICA, placed at about 5 m height, with a tilt angle with the horizontal plane of about -45 degrees.
HCV_010 The tool shall provide a crowd monitoring functionality, including anomaly detection in crowd behaviour, crowd density estimation and group detection.	LEA expert	1,50	Only the crowd density exstimation functionality is currently implemented; the other ones are under implementation. While in the PD1, it was not possible to validate this requirement since the HCV tool could not be properly assessed by the Ertzaintza, in the PD5 it was not possible to evaluate efficiency and efficacy during LEA operators' duties, since the officers who validated the tool were members of a Police Officers School and were not directly involved in CCTV-related monitoring tasks during mass gathering events. However, they remarked that this tool looks as a valuable add-on for officers and operators directly involved in those tasks.
HCV_016 The crowd monitoring tool may process videos acquired by RPAs, if allowed by EU regulation on this matter currently in progress.	Technology provider	1	No RPAs were used to acquire videos during the PDs.
IMAGE-BASED PERSON RE-IDENTIFICATION			
HCV_008 The tool should respect the principle of non-discrimination.	Technology provider	3	The HCV tool collects the images of all the individuals detected in the processed videos, and matches them with an image selected by a LEA

			operator only on the basis of low-level image features (e.g., colour histograms and texture). No high-level matching criteria susceptible to of being discriminatory are used.
HCV_011 The tool should provide a person re-identification functionality: given a query image of an individual of interest, it will return a list of images of individuals exhibiting a similar clothing appearance, sorted for decreasing similarity to the query.	LEA expert	1,50	In PD1, it was not possible to validate this requirement since the HCV tool could not be properly assessed by the Ertzaintza officer. The tool provides the mentioned functionality. However its accuracy was found to be not satisfactory yet for real operational environments. LEAs officers remarked that this tool looks as a valuable add-on for officers and operators, although its effectiveness (accuracy) can be low in mass gathering events where many people are likely to wear similar clothing (e.g., supporters of popular football teams).
HCV_013 The person re-identification and people search tools will process videos from standard, fixed/PTZ/mobile (managed by stewards/agents), video surveillance colour cameras. Tilt angle with horizontal plane: less than -45 degrees; height: about 3 m or less.	Technology provider	2	Publicly available videos exhibiting the required characteristics have been used during the HCV tool design. IN PD4, this functionality were tested on videos acquired during the PD only from PTZ colour cameras (four) provided by the Belgian Federal Police, placed at about 3 to 5 m height, with tilt angle lower than -45 degrees with the horizontal plane. In the PD5, the person re-identification functionality was tested on videos acquired during the PD from four fixed colour cameras, placed at about 1.5 to 3 m height, with tilt angle lower than -45 degrees with the horizontal plane.
ATTRIBUTE-BASED PEOPLE SEARCH			
HCV_012 The tool should provide a people search functionality: given a description of clothing appearance, it will return a list of images of individuals matching that description, sorted for decreasing degree of matching.	Technology provider	1	In PD1, the attribute-based people search functionality was still under implementation and it was not available. In PD4 and PD5, the tool provided this functionality. However, in PD4, its accuracy was found to be not satisfactory yet for real operational environments. While in PD5, it was not possible to validate this requirement, since the officers who validated the tool were members of a Police Officers School and were not directly involved in CCTV-related monitoring tasks during mass gathering events. LEAs officers remarked that this tool looks as a valuable add-on for officers and operators, although its effectiveness (accuracy) can be low in mass gathering events where many people are likely to wear similar clothing (e.g., supporters of popular football teams).
HCV_013 (see above)	Technology provider	1,83	In PD1, the attribute-based people search functionality was still under implementation and it was not available. IN PD4, this functionality were tested on videos acquired during the PD only from four PTZ colour cameras provided by the Belgian Federal Police, placed at about 3 to 5 m height, with tilt angle lower

			<p>than -45 degrees with the horizontal plane.</p> <p>In the PD5, the functionality was tested on videos acquired during the PD from four fixed colour cameras, placed at about 1.5 to 3 m height, with tilt angle lower than -45 degrees with the horizontal plane.</p>
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4.2.3.4 General recommendations

In general, all the participants agreed that the tool could be very useful, but to be effective in a real operational scenario the accuracy of its components should be enhanced.

The main suggestions arose during the debriefing sessions were the following:

- Increase the accuracy of the *HCV person re-identification and people search* functionalities in order to improve their effectiveness, especially in mass gathering events where many people are likely to wear similar clothing (cfr. HCV_011, 012). The following specific suggestions were collected:
 - During the PD4 in Malle, the person re-identification and people search components retrieved many false positive images (i.e., images of individuals different from the one searched for). This was to some extent due to inherent limitations of the underlying computer vision algorithms when applied to complex scenes (due to many individuals appearing in the videos, difficult lighting conditions, complex background, limited training sets, etc.). Some LEAs were thought that it was counterintuitive to see that some of the false positives exhibited a very different clothing appearance than the individual searched for; e.g., people wearing dark clothing were retrieved when searching for an individual (a volunteer) with a red jacket;
 - Similarly, among the retrieved images many images of a same individual appeared, apparently for consecutive video frames. This is due to the fact that in the current version of the tool each frame of a video is processed separately. This problem can be overcome by using a pedestrian tracking tool, and by retrieving only one image by each track;
 - A minor issue concerning the attribute-based people search tool was that in its user interface the different kinds of attributes should be shown in a more logical order, e.g., the ones related to upper-body should be grouped and shown before the lower-body attributes, etc.;
 - The appearance-based person re-identification functionality would be useful if it is able to detect (match) the person of interest also when that person appears on videos coming from a PTZ camera while it is tilting, panning or zooming.
- Improvement of some functionalities of the *crowd density estimation tool*:
 - As pointed out by some experts, in its current version the crowd density estimation tool provides an estimate of the number of people in a whole video frame, and also in a rectangular region of interest inside a frame, which can be manually selected by an operator. It would be useful to allow the selection of a region of interest of any polygonal shape (by choosing its vertices), not only rectangular;
 - Experts from the Bavarian police thought that some features of the tool the crowd density estimation appeared interesting, but its accuracy can be an issue in specific settings. For instance, when the crowd size is near to the capacity of the venue a very high accuracy is

- required to avoid, e.g., that an overcrowding gets undetected. On the other hand, in some settings officers can estimate the crowd size relatively easily;
- It would be very useful if the crowd density estimation components can provide also the level of accuracy together with the estimated number of people, depending on the operational conditions (for instance, the level of accuracy under good lighting is likely to be higher than under poor lighting).

It was also suggested to make the HCV tool available in other languages beside English (Spanish in this case).

4.2.4 Innovative communication procedures (ICP)

The Innovative Communication procedures (ICP) aim at enhancing event organisers, security officers and first responders' crowd awareness and communication competences in the pre-event phase and execution phase of a mass gathering event. ICP looks like a Communication toolkit. It provides the users with some helpful tips and recommendations to plan and improve the effectiveness of the communication strategies, the messages to be issued during critical situations and crowd behaviours to be fostered both in routine as well as critical situations.

The PD in Rome aimed to test some of the main components of the communication toolkit to assess the usefulness and usability of the tool taking into account the experts' perspective.

The main components evaluated were the following:

- General communication guidelines to communicate with multicultural crowds in the pre-event and execution phases of a mass gathering;
- Warning message map template;
- Triggering questions;
- Specific communication guidelines concerning sporting events (pre-event and execution phases).

Two participants were involved in the PD: one coordinator of the stewards at the Olympic stadium and one coordinator (public order sector) of the operative Room of the Rome Police headquarters.

The detailed description of the validation exercise carried out during the practical demonstration is described in the following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.4.2, 4.2.4.3 and 4.2.4.4.

4.2.4.1 Description of the validation exercise in PD3 Rome

The following tables report the details of the validation exercises carried out to assess the first version of the innovative communication procedures toolkit.

Table 16: ICP – PD3 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of two people from Deep Blue with different roles: one moderator and one note taker.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	Two participants took part in the PD: <ul style="list-style-type: none"> • 1 coordinator of the stewards at the Olympic stadium • 1 coordinator (public order sector) of the operative Room of the Rome Police headquarters

TYPE OF EXERCISE	Evaluation workshop
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Participants were asked to go through the different tools assigned and share their expert opinion about the usability and usefulness of the toolkit in their working activities. A mediator facilitated the discussion. Participants had 15 min to go through the different components of the toolkit as follows:</p> <ul style="list-style-type: none"> • The coordinator of the stewards assessed the specific communication guidelines and the triggering questions. • The coordinator of the operative room assessed the generic communication guidelines and the warning message map template. <p>A common discussion lasting 1 hour was carried out. For this purpose some leading questions were formulated to facilitate the interaction as follows:</p> <ul style="list-style-type: none"> • Do you have similar tools supporting the communication aspects in your everyday working practices? • How would you use these tools? • What would be their added value? • What would be their possible criticalities?
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	<p>Short presentation of the communication toolkit and its main components was carried out through a PPT presentation.</p> <p>A draft version of the toolkit was printed for the participants.</p>
CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A.
GENERAL NOTES AND COMMENTS FROM THE TP REGARDING THE EXECUTION OF THE PD	The tool components tested during the PD were translated in Italian to facilitate their understanding.

4.2.4.2 Validation questionnaire results

The following sections will report the main results collected during the PD1 in Bilbao. After the execution of the validation exercise in the previous paragraph, participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.4.2.1 Usefulness

The two experts reported that the communication toolkit would be very useful as supporting tool to organise the relevant information to build an effective communication strategy. As reported during the debriefing session, the added value of the tool consists on the systematisation of the communication elements to be taken into account when preparing the communication plan for a given event. Some of the main components of the communication toolkit can help thinking and stimulating the design of the communication strategy. For example the triggering questions can be used as checklist, allowing the identification of lacks, missing points and to verify that all the relevant communication aspects have been addressed.

In addition to this, the contents and main components of the communication toolkit were considered useful as they reflect the communication practices currently used by the experts during the preparation

phase of an event.

4.2.4.2.2 Usability

The SUS score mean value for the ICP was 93.8. This means that the experts involved in the evaluation considered the usability and comprehensibility of the tool excellent (see section 8 - ANNEX B for further information on SUS scores interpretation). The figure below shows the individual SUS scores.

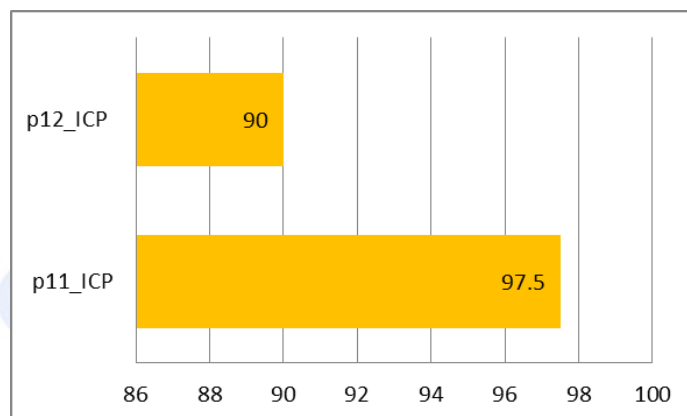


Figure 32: ICP - Individual SUS scores

Overall, participants agreed that:

- they would like to use the tool frequently;
- the toolkit was easy to use;
- the learnability of the tool was good. After a short introductory presentation, participants felt very confident in using it. They would not need any support in using it during daily working situations;
- the main components of the tool seem well integrated and designed.

4.2.4.2.3 Effectiveness and Compatibility

As shown in Figure 33, the participants involved in the validation process assessed the tool as very effective to complete their working activities.

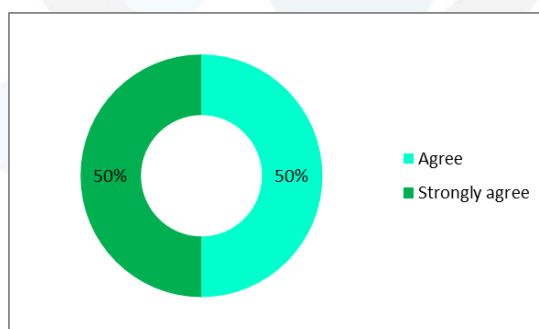


Figure 33: ICP effectiveness scores - I can effectively complete my work using this tool

All the participants agreed that the innovative communication procedures are compatible with their current practices and procedures (see Figure 34 and Figure 35). One expert pointed out that the communication toolkit would be applicable in real situations. For example, when preparing the communication strategy for a mass gathering, it can support the key stakeholders and the police officers in organising the communication approach in a structured way.

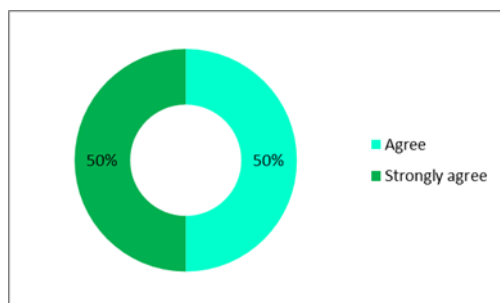


Figure 34: ICP compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

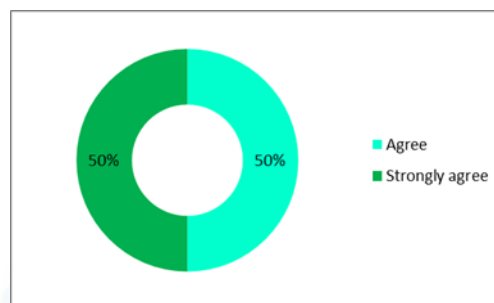


Figure 35: ICP compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.4.2.4 Maturity

The figure below shows the ICP maturity levels scores. The participants rated the tool as TR6, “The tool prototype or model is ready to be tested in a relevant environment”. This is in line with the results described in the previous sections.

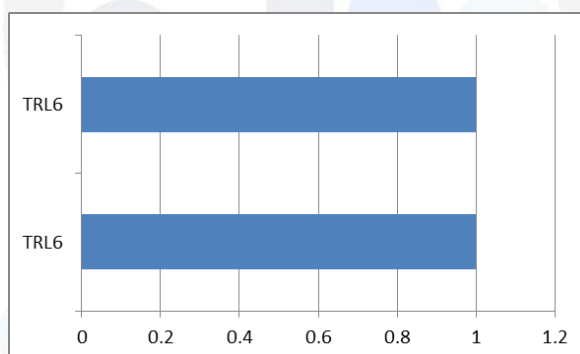


Figure 36: ICP maturity level scores

4.2.4.3 Requirements acceptance scales

Concerning the ICP requirements, one of them (ICP_10) has been updated and a new one added (ICP_11) (see section 9 - ANNEX C). The majority of the requirements were validated from the user’ perspective, while few others (i.e. ICP_002, 004, 005, 007) from the technology provider’s point of view. Participants were asked to fill in the requirements acceptance scale to validate the requirements referred to the tool’s components and functionalities that they used during the practical demonstration at the end of the PD3. Two experts were involved in the requirement validation.

An overview of the requirements level of acceptance is shown in the Figure 37.

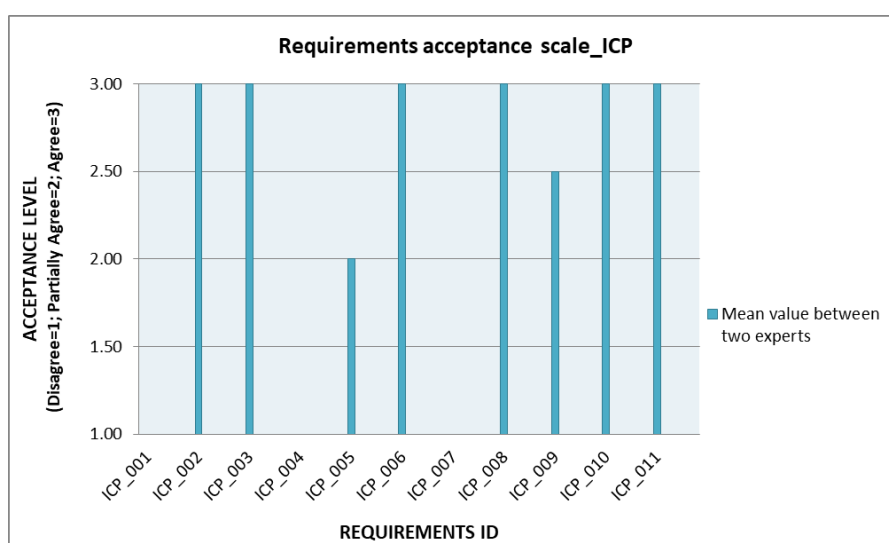


Figure 37: ICP – Requirements assessment scale results

In the Table 17 a qualitative rationale for the assessment given to each ICP requirement is provided, together with the type of validator (i.e. LEA expert or Technology provider) and the requirement level of acceptance. It corresponds to the mean value - between the two experts involved - of each requirement.

Table 17: ICP – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
ICP_001 Guidelines shall include an emergency communication framework to support LEAs and other involved stakeholders in developing an effective strategy to communicate with the public.	Technology Provider	1	This requirement has not been validated in the PD3. However, the ICP – communication toolkit includes a set of three <i>Emergency Communication Cards</i> focused on the crisis communication applied to the evacuation process.
ICP_002 Guidelines shall support LEAs and other stakeholders in identifying the best communication strategy to ensure public trust the information received and behave properly during the emergency.	LEA/ private security expert	3	The ICP - communication toolkit facilitates operational tasks since it is very usefulness and well designed.
ICP_003 Guidelines shall support LEAs and other stakeholders in identifying the best communication strategy to ensure a proper	LEA/ private security expert	3	The ICP - communication toolkit could help to critically reflect on likely risks of a mass gathering in order to identify the best communication strategy to avoid risks during the emergency.

management of the public (avoiding risks), during the emergency.			
ICP_004 Guidelines shall support LEAs and other stakeholders in identifying a participative communication strategy to ensure the collaboration of the public in recognizing and managing possible critical situations.	LEA/ private security expert	1	The not acceptance of this requirement from the validator is due to two main reasons. From one hand, because the ICP is perceived helpful only for the event organizers and those stakeholder involved in the communication management (e.g. on the ground) and not for the people attending the event. From the other hand, because one of the two validators (i.e. the LEA officer) considers as “impossible” the setup of a communication strategy that involves the public as partner in recognizing and managing possible critical situations.
ICP_005 Guidelines shall address the following socio-cultural factors when developing a communication strategy for multiple risk scenarios: Age, Gender, Social Identity, Language, Signs/ Symbols, Individual differences.	LEA/ private security expert	2	The medium level of acceptance of this requirement is due to the fact that one of the two validators (i.e. the LEA officer) considers as “impossible” taking into account all the listed socio-cultural factors when developing a communication strategy. Otherwise, the other validator recognizes the toolkit as helpful to develop a communication strategy that addresses crowd’s socio-cultural factors.
ICP_006 Guidelines will be in English and easy to be translated into other languages by their users.	Technology Provider	3	ICP is in English but it can be easily translated into other languages. In the PD3, for example, the tool components tested were translated into Italian to facilitate their understanding.
ICP_007 Guidelines shall include a multi-channel approach to effectively communicate with a multicultural crowd.	LEA/ private security expert	1	When using the ICP components, the two validators have not clearly identified the multichannel approach included in the toolkit.
ICP_008 Guidelines shall include the state of the art in emergency communication with multicultural crowd.	Technology Provider	3	The ICP – communication toolkit components have been built according to the most relevant studies on emergency communication and emergency crowd behaviours.
ICP_009 Guidelines shall clearly identify other stakeholders that could be involved and their roles in the communication strategy.	LEA/ private security expert	2,50	ICP – communication toolkit specifies stakeholders involved, and their roles, in the communication with crowds in relation to different types of events.
ICP_010 Guidelines shall include an illustrative workflow to facilitate the application of the communication strategy to an event.	Technology Provider	3	ICP – communication toolkit includes an illustrative workflow suggesting which tools components could be used to set up a communication strategy for an event, and with respect to what activities and purposes.

ICP_011 Guidelines should be compatible with the communication procedures already applied by the stakeholders in charge of communication in a mass gathering.	LEA/ private security expert	3	ICP have been evaluated as fully compatible with procedures and practices already applied in the experts' organizational contexts.
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4.2.4.4 General recommendations

Based on the feedback gathered from the experts involved in the PDs some general recommendations can be derived.

Participants' suggestions were mainly addressed to adjust or modify the contents of some components of the communication toolkit. For example the coordinator of the stewards suggested to remove one indication from the specific communication guidelines because they would not been applicable in real operational environments.

One expert also suggested including some indications for the hand-gestures and non-verbal communication.

4.2.5 Policy making toolkit (PMT)

The PMT (Policy Making Toolkit) is a web application. This is a piece of software with a client side (LEAs) and a server-side where the client runs in a web browser. The tool aims to gather all the relevant information related to mass gatherings in order to help decision making about authorization and policies.

The PMT was tested during the first PD in Bilbao aiming to:

- Test the main features of the PMT (venues, signals, policies, incidents, tags, geographical information, chat and so on) during the event preparation and during event execution;
- Show the tool to the LEAs in order to know their impression and to define the upcoming improvements of some aspects of the tool.

The main components assessed during the PD were:

- **Events.** They can be chosen about 500 possible fields and configurable.
- **Venues,** containing a list of fields: Data of the venue, Geographical information, multimedia information related to the venue, confidential information, accessibility, access points.
- **Signals.** Similarly to venues this contains basic information about: the level of the signal; to which events the signal is related to; georeferenced information; multimedia information.
- **Policies.** They are the laws registered in the system. The policies contain 3 different parts: conditions and mandatory with 500 possible fields to be configured and recommendations, which are the actions to be taken if policies are okay.
- **Incidents.** They represent the incidents in the LETSCROWD system. The fields are: Type, gravity and description. There is also a field concerning the event/signal to which the incidents are related.
- **Tags,** i.e. specific word assigned to Signals or Events related to its semantic meaning.

- **General Maps.** At the same venue can be happening different events at different periods of times. The geographical map provides information related to: a) **Events.** Venue associated, related signals and sensible zones associated; b) **Signals** not related to any event.
- **Private Chat.** Rocket Chat is a customizable, secured and unrestricted web application embedded in the PMT system used for sending customized text and multimedia messages to the server. It will be used by LEAS for sending suspicious information by a mobile terminal of the specific event to the server. For each event in the system, a new channel will be created in the system and all the information will be sent to that channel.

Two participants were involved in the validation activity: 1 data analyst from ERT and 1 police officer from ADM.

The detailed descriptions of the validation exercises carried out during the practical demonstration are described in following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.5.2, 4.2.5.3 and 4.2.5.4.

4.2.5.1 Description of the validation exercise in PD1

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of three people from ETRA with the different roles: two as software developers and one as the project manager.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>A manager from ETRA, responsible for planning the practical demonstration with the rest of our own staff and with the LEAs.</p> <p>Two software developers from ETRA, collecting and filling out the information of the event, configuring and running the PMT tool and proving the result to the different LEAs.</p> <p>2 evaluators:</p> <ul style="list-style-type: none"> • 1 from ERT (security analyst) • 1 from ADM (senior staff with enough expertise in the field of mass events).
TYPE OF EXERCISE (e.g. : <ul style="list-style-type: none"> • WK/ FG - Workshops/ focus groups • TFX - Technical and functional exercises • TTX – Table Top Exercise • FSX - Full-scale exercises 	<p>TFX - Technical and functional exercises.</p> <p>The work carried out was, essentially, to test the web application of the PMT with the LEAs in order to familiarize them with the tool and know their fundamental opinion as experts. The suggestions for the improvement of the tool were taken into account by the staff from ETRA. LEAs' suggestions fundamentally concerned the PMT visual parameters in relation to the geo localization aspects.</p>
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	This first exercise of PD aimed to show the PMT taking into account the tool components (previously explained) and further feedback from LEAs. The PMT information and fields were analysed to understand if the different inputs were well designed.
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	The PMT was showed during the PD explaining its different components. After this introduction, LEAs from ERT and ADM used it in order to provide their feedback.

CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A
OTHERS GENERAL NOTES AND COMMENTS REGARDING THE EXECUTION OF THE PD	The PMT is deemed to be related to other LETSCROWD tools (external to PMT). Thus, it will gather the data obtained from the SIE, CMP, HCV and RTE. Even though the main aspects to improve have been identified in the PD1, a full feedback from LEAs will be possible only when the integration among these tools will be achieved ⁶ .

4.2.5.2 Validation questionnaire results

The following sections will report the main results collected during the PD1 in Bilbao. After the execution of the validation exercise (see previous section), participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.5.2.1 Usefulness

The two participants thought that the tool would be very useful to gather all the relevant information related to mass gatherings and support decision makers about authorization and policies. Participants appreciated the possibility to record the history of a specific event that can be used as lesson learnt for other events.

The most important feature of the tool was the possibility to visualise the different risks that could exist in a given event. While a suggestion for further improvements would be to include the possibility to correlate two events at the same time, as in the current version users are not allowed to do it.

4.2.5.2.2 Usability

The general level of usability of the tool can be considered good as the SUS score mean value was 67.5. The individual SUS score are shown in the figure below.

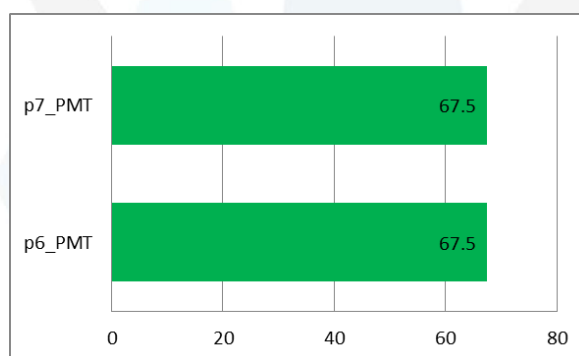


Figure 38: PMT – Individual SUS scores

Both participants agreed that they would use the tool frequently.

At the beginning the tool was not easy to use but both the experts stated that a user manual would improve the general learnability of the tool.

⁶ A preliminary tentative integration of the PMT with the other LETSCROWD tools is reported in section 4.2.9.

Overall the main components of the tool seemed to be well integrated, however LEAs would expect an integration of this tool with the other LETSCROWD tools (see section 4.2.9).

4.2.5.2.3 Effectiveness and compatibility

The experts involved in the assessment thought that they would be able to effectively complete their working activities by using the tool (Figure 39).

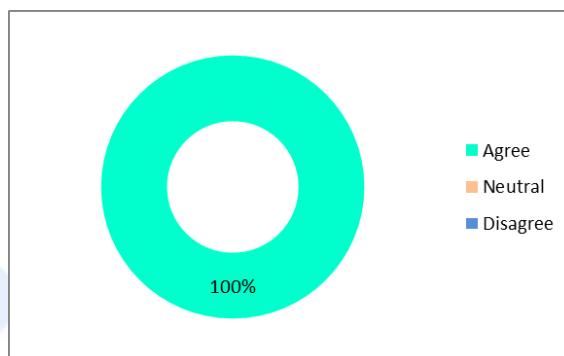


Figure 39: PMT effectiveness scores - I can effectively complete my work using this tool

Regarding the compatibility of the tool with the operational procedures currently in place (Figure 40) and its applicability in real situations (Figure 41), the experts agreed that the tool has the potential to support them in carrying out their tasks.

Both LEAs thought that the steps taken are in a good direction and in the future, once the PMT tool will be integrated with other LETSCROWD tools, it could be very helpful in helping them to increase the security of a mass gathering event.

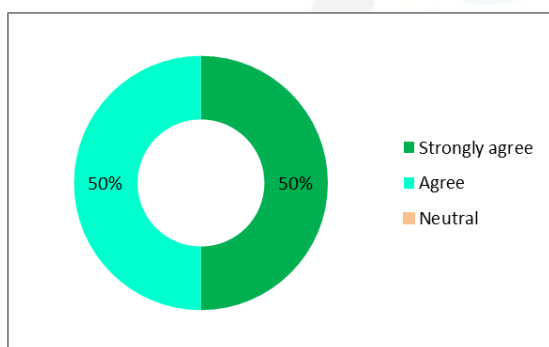


Figure 40: PMT compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

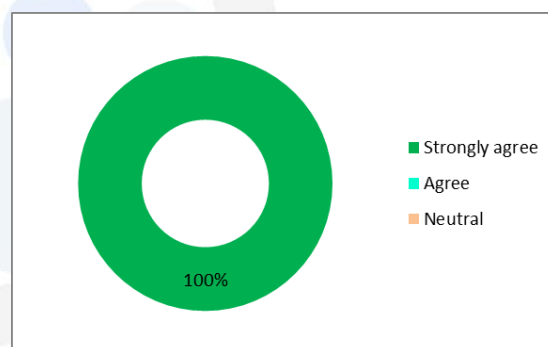


Figure 41: PMT compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.5.2.4 Maturity

Participants rated the tool as TRL 4 (see figure below). As stated before the main components of the tool seemed to be well integrated, but to be really effective the tool should be integrated with the other LETSCROWD tools.

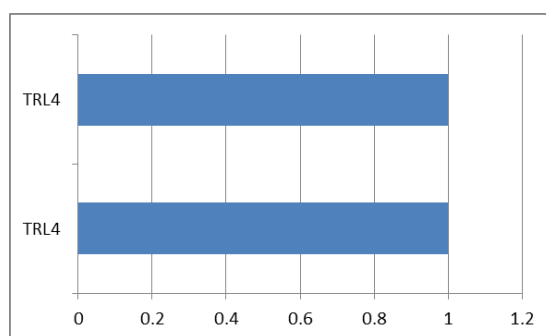


Figure 42: PMT maturity level scores

4.2.5.3 Requirements acceptance scales

The requirement validation was carried out by two LEAs officers (one from Ertzaintza and one from ADM) participating in the PD1. They were asked to complete the requirements acceptance scales at the end of the PD1. Among the 29 requirements concerning PMT, four requirements have been updated (i.e. PMT_008, 017, 019, 029) with respect to the first version included in the D2.1 (see section 9 - ANNEX C).

An overview of the requirements level of acceptance is shown in the Figure 43.

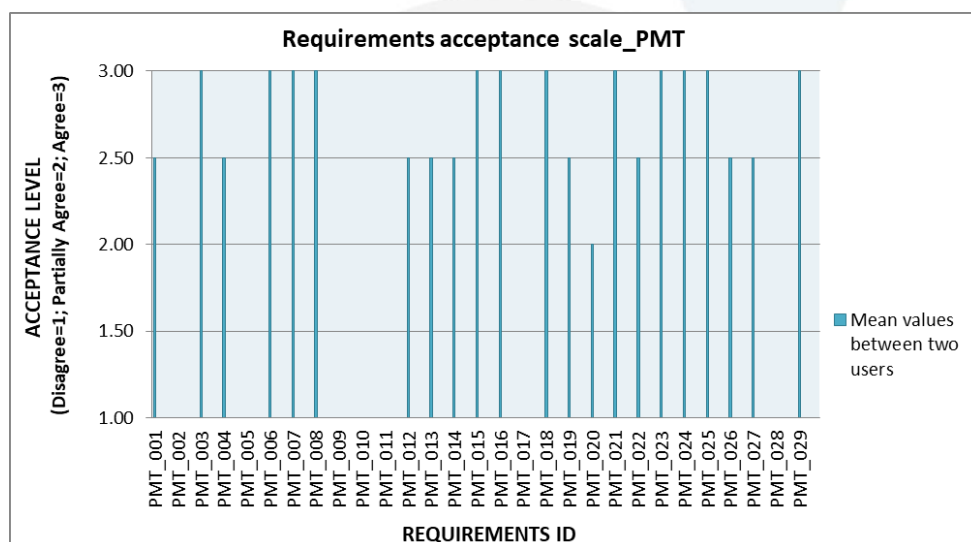


Figure 43: PMT – Requirements assessment scale results

In the Table 18 a qualitative rationale for the assessment given to each PMT requirement is provided, together with the related level of acceptance (i.e. the mean value - between the two experts involved - of each requirement). Concerning the PMT, all the requirements were validated according to the LEAs experts' point of view.

Table 18: PMT – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
PMT_001 The tool will help authorities to make a decision to approve or not a planned crowded event,	LEA expert	2,50	The PMT includes this option but it is necessary to include more policies for helping decion makers to approve or not a planned event.

based on a database with data of past events and rules and measures based on the data of the current event.			
PMT_002 The tool will use the data introduced to grow the database and make it smarter than before with every use.	LEA expert	1	This functionality had not been developed yet at the time of PD1. LEA experts could not validate the related requirement.
PMT_003 The tool will contain an initial database of the most important and different events before releasing the tool.	LEA expert	3	PMT allows differentiating the different events. There are many fields to fill out for each separate event.
PMT_004 The tool should be as friendly and fast as possible with auto completion features, keyboard shortcuts and helpers.	LEA expert	2,50	PMT is friendly enough and has shortcuts helping to fill out the information. Helpers should be improved.
PMT_005 The tool should to not make the user wait for loading processes when filling the form.	LEA expert	1	This functionality had not been developed yet at the time of PD1. LEA experts could not validate the related requirement.
PMT_006 The tool will be at least in English.	LEA expert	3	PMT is in English.
PMT_007 The tool will have different user roles (Event planner has different access type than LEA or person that authorizes event).	LEA expert	3	PMT allows differentiating among the different users roles.
PMT_008 The tool considers 6 different statuses for an event.	LEA expert	3	PMT considers different status of an event, i.e.: pending, approved, active, closed, cancelled.
PMT_009 The tool will allow registering and handling users with different roles.	LEA expert	1	This functionality had not been developed yet at the time of PD1. LEA experts could not validate the related requirement.
PMT_010 The tool will be able to communicate with the other applications and integrate useful data from them.	LEA expert	1	This functionality had not been developed yet at the time of PD1. LEA experts could not validate the related requirement.
PMT_011 The tool must be able to include other languages easily.	LEA expert	1	PMT was only in English.
PMT_012 The tool should allow to create more roles as needed.	LEA expert	2,50	PMT allows creating more roles but it is necessary to define the access level for each role. Currently, it is not possible to give different level of access.
PMT_013 The tool should allow to create more event states as needed.	LEA expert	2,50	No rationale has been provided for this assessment.
PMT_014 The tool will include a list of predefined values for each aspect related	LEA expert	2,50	A list of predefined values for each aspect related to event was included in the PMT.

to event.			
PMT_015 The tool will allow the authority to create a report after authorising or denying and after closing an event.	LEA expert	3	It is possible consult any data after that an event has been closed. However, the PMT tool does not create a report by itself.
PMT_016 The tool should contain an initial database of security policies, best practices and guidelines related to mass gatherings.	LEA expert	3	The PMT includes an initial database, but the number of security policies has to be increased.
PMT_017 The tool should have an initial database of relevant information, including that one regarding citizen's reactions and perceptions, useful to the policy making process.	LEA expert	1	This functionality had not been developed yet. The policies are inserted and customized by the admin but there is not any initial database.
PMT_018 The tool will be able to be easily updated with new inputs.	LEA expert	3	PMT can be very easily updated with new inputs.
PMT_019 The tool should be able to support policy makers regarding different types of policies, for different levels of planning, control and management and diverse sort of events.	LEA expert	2,50	PMT is able to support policy makers, but the types of policies need to be increased.
PMT_020 The tool will allow reference for all LEAs and authorities across the EU.	LEA expert	2	PMT allows reference for LEAs and authorities but only at national level. Policies can be included manually.
PMT_021 The tool will have a search feature for the database.	LEA expert	3	PMT has a search feature for the database.
PMT_022 The tool should allow to create reports of any kind to ensure EU standardization.	LEA expert	2,50	PMT allows creating reports only for the policies not for all the event.
PMT_023 The tool will have a section to just add data to the database.	LEA expert	3	PMT allows adding data in the database through a specific section.
PMT_024 The tool should index added information to the database.	LEA expert	3	PMT includes the tags option for indexing added information.
PMT_025 The tool may show relevant and related data when entering data.	LEA expert	3	PMT can show relevant data thanks to the diagram and map option. This part of the tool is considered as very helpful.
PMT_026 The data analytics tool will process data stored in a database structured according to a precise data	LEA expert	2,50	Even though this functionality cannot be assessed by the LEAs experts, it is currently integrated in the PMT.

model.			
PMT_027 The data analytics tool will provide search and visualization functionalities to each category of users of the PMT.	LEA expert	2,50	PMT currently includes this functionality, but one aspect is missing: to develop <i>per</i> user levels.
PMT_028 The access to the data of the PMT database through the data analytics tool will be limited according to the role of each category of users.	LEA expert	1	This functionality had not been developed yet at the time of PD1. LEA experts could not validate the related requirement.
PMT_029 Data consistency is checked in the database when they are added.	LEA expert	3	It is possible to check data consistency in the database.

4.2.5.4 General recommendations

LEAs' suggestions collected during the PD fundamentally concerned the PMT visual parameters in relation to the geo localization aspects. The main suggestions came out during the debriefing sessions were the following:

- Improvement of the tool visuals aspects, especially with respect to the georeferenced information of the event and how to aggregate more information in this visual field. The potential improvement concerns the correlation between different events that are part of the same map taking account mass gatherings and how the PMT could improve the usual systems that they currently have.
- The expert from ADM clarified that once this tool will be integrated with the others LETSCROWD tools, it will offer a real added value.
- Even though PMT is perceived as a friendly tool, helpers should be improved.
- PMT should create reports for all the events.

Moreover some experts pointed out that in order to help authorities to make a decision whether to approve a planned crowded event, a higher number of policies should be included.

4.2.6 Pre-event security decision tool (PSD)

The Pre-event Security Decision (PSD) software has been designed to help LEAs to know the level of security hazard of the mass gathering (e.g. fan-zone, stadium and venue of the celebration) and recommend the general security instructions and precautions in place. Inputs are related with: 1) the *event* (type of event, conflict history, event duration), 2) the *venue* (venue type, space for crowd, assets to protect), 3) the *crowd* (number of people, age, purpose, expected crowd behaviour, membership participation, membership identification) and 4) *intelligence* (expected infringements, terrorist alert level). Outputs include: 1) indicator of security hazard (value between 0 and 1): Low (0-0.25), Medium, (0.25-0.50), High (0.50-0.75) and Extreme (0.75-1.00) displayed on the screen, 2) task force protocols based on indicator of security hazard: Protocol 1 (Low), Protocol 2 (Medium), Protocol 3 (High) and Protocol 4 (Extreme) displayed on the screen, 3) summary report and 4) file of the event to be further used.

The PSD was tested during the first PD in Bilbao, the main objectives were to:

- use and test the PSD tool during the pre-event phase of MTV events (small concerts and stellar concert) for supporting the hosting LEA (ERT) in security planning actions;
- use and test the PSD during the MTV stellar concert in San Mamés Stadium;

- interact continuously with the ERT and receive its feedback;
- define improvements for the PSD tool and define further actions.

Two experts from ERT and INTERNO were involved in the validation.

The detailed description of the validation exercise carried out during the practical demonstration is described in the following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.6.2, 4.2.6.3 and 4.2.6.4.

4.2.6.1 Description of the validation exercise in PD1

The following table report the details of the validation exercise carried out to assess the first version of the Pre-event Security Decision tool.

Table 19: PSD – PD1 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of three researchers from the University of Cantabria.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>A manager from the UC: responsible for overseeing and planning the practical demonstration;</p> <p>A host from the ERT: member of staff in host LEA that has access/influence to the implementation of the PD and is sufficiently senior to liaise with those with overall responsibility for the event;</p> <p>An assistant from the UC: responsible for performing tasks identified by the Manager (M)- collecting and analysis the information of the events, configuring and running the PSD tool and providing results to ERT.</p> <p>2 Evaluators: 1 from ERT, 1 from INTERNO (LEAs personnel responsible for evaluating the PSD tool).</p>
TYPE OF EXERCISE	<p>TFX. Two kind of exercises were conducted:</p> <ul style="list-style-type: none"> • Pre-event <ul style="list-style-type: none"> ○ 3 small concerts from 29th October to 1st November, 2018 (Barakaldo, Miribilla and Durango) ○ Stellar concert at San Mamés Stadium on 3rd November 2018. • Event execution <ul style="list-style-type: none"> ○ Stellar concert at San Mamés Stadium on 3rd November 2018. ○ Spontaneous protests against the MTV in Bilbao City Hall. <p>WK. This workshop, conducted during the PD last 3rd November 2018, aimed to familiarize LEAs personnel (from ERT, INTERNO and ADM) with the PSD tool and allowed gathering suggestions and feedback for the outcome's improvements from an expert perspective.</p>
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Pre-event:</p> <p>The PSD was applied to the following small concerts in advance (two weeks before):</p> <ul style="list-style-type: none"> • Barakaldo 29th October • Durango 30th October • Bilbao-Miribilla 31st October

- San Mamés 3rd November

ERT provided information of the events to UC. The information was analysed to define the inputs for each mass gathering event. The UC, supported by ERT, analysed the events using the PSD (11). The results in PPT were sent to ERT as support for security planning actions. An example of PPT provided is shown in section 11 - ANNEX E.

Event execution:

The PSD tool was explained to each LEA personnel involved in the PD and directly run for the analysis of the Stellar Concert in San Mamés Stadium. Input parameters were varied assuming different hypotheses (i.e. updated information from intelligent sources).

It is important to note that during the PD, a spontaneous event was detected by ERT intelligence. The event consisted of a protest against the MTV in the Bilbao City Hall. The PSD was run to analyse this unpredicted protest providing fast preliminary results (in less than 60s) of the security hazard level and the corresponding security protocols. That way, LEAs personnel could see how the tool works under such conditions.

PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	A short demonstration running the software in a laptop was conducted during the PD. Furthermore, LEAs personnel had the opportunity to use and test the tool by themselves for hypothetical events and compare the PSD outputs with their own criteria.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A.
OTHERS GENERAL NOTES AND COMMENTS REGARDING THE EXECUTION OF THE PD	The PSD tool is currently applied by ERT for upcoming mass gathering events. The feedback will be sent to UC for further improvements.

4.2.6.2 Validation questionnaire results

The following sections will report the main results collected during the PD1 in Bilbao. After the execution of the validation exercise (see previous section), participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.6.2.1 Usefulness

The two participants rated the tool as very useful. The PSD was considered useful to systematize a prior risk analysis before a mass gathering event. It supports the decision maker to assess the situation and to deploy more or less resources according to the situation. Although the final decision should be taken by a person (or a group of decision-makers), a tool of this type offers an objective evaluation based on the data introduced.

All the main features of the tool were considered good. Participants agreed that the logic of the tool and the items to be taken into account are well defined.

4.2.6.2.2 Usability

The SUS scale was filled in by the participants, with a mean value of 78.8. This means that the general tool's usability was considered good.

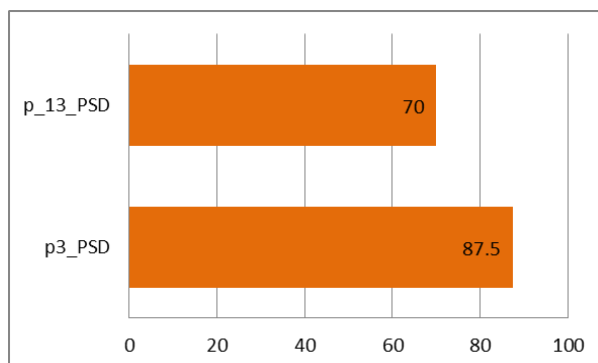


Figure 44: PSD – individual SUS scores

Both experts agreed that they would be willing to adopt and use the tool within their organisation. One police officer from Ertzainza specified that within the Basque Country (Euskadi) there are numerous events of different nature (e.g. sporting, cultural, festivals ect.), each with particular characteristics and very different public characteristics. In this context the PSD tool would serve to standardise the risk assessments.

Overall, SUS scale addresses three main aspects of the system usability like the need for support in using the scale, training and complexity of the tool. Participants' opinions on these aspects are synthetized as follows:

- *Learnability of the tool and training:* the two participants agreed the PSD too was easy to learn and that people would learn to use this tool very quickly. The introductory explanation made at the beginning of the validation sessions was considered enough by the participants to be able to use the tool individually. In line with this, the two participants felt very confident in using the tool during the PD.
- *Complexity:* participants' opinion on the tool complexity was considered low. In general, the main features and components seemed well integrated and designed.

4.2.6.2.3 Effectiveness and Compatibility

The experts involved in the assessment reported that they can use the tool to effectively complete their working activities (Figure 45).

One of the experts pointed out that the tool is not only effective, but it provides objectivity and methodological standardization that could be relevant for managing a mass gatherings event where different changing variables have to be taken into account at the same time.

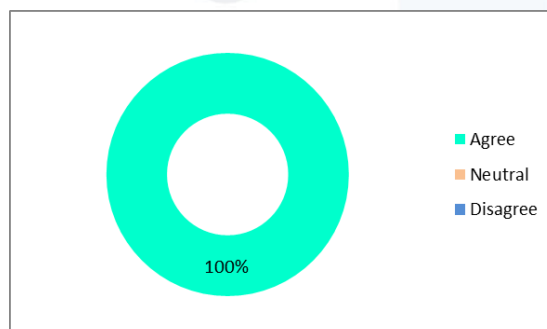


Figure 45: PSD effectiveness scores - I can effectively complete my work using this tool

Although, the two experts agreed that the tool was compatible with the operational procedures currently in place within their organisations (Figure 46) and applicable in real situations (Figure 47); the input provided by the PSD should not be binding for the operator. It could be used as a useful source of information, but the final decision should be human oriented.

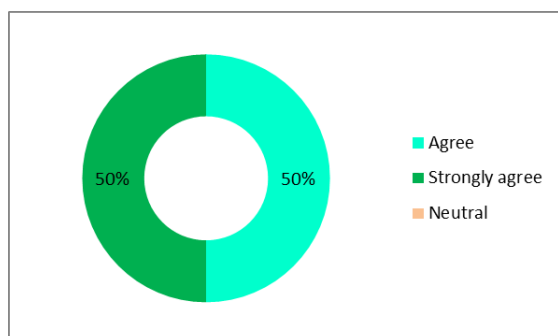


Figure 46: PSD compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

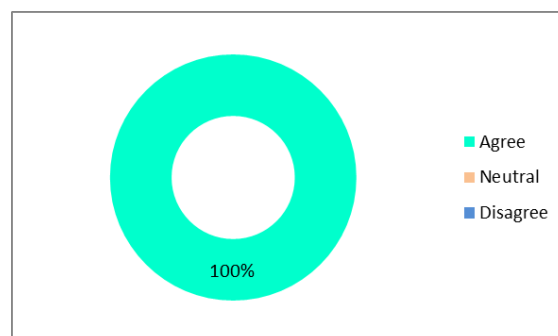


Figure 47: PSD compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.6.2.4 Maturity

The figure below shows the PSD maturity levels scores. The participants rated the tool as TR5; this means that the main components of the tool seemed to be well integrated to be used in a simulated operational environment.

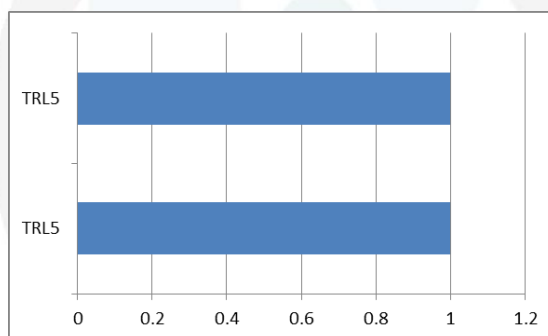


Figure 48: PSD maturity level scores

4.2.6.3 Requirements acceptance scales

The PSD requirements were not included in D2.1. Four new ones were identified as part of the PMT requirements (see section 9 - ANNEX C), since the PSD could be considered as a component of this tool that supports specific functionalities (i.e. knowing the level of security hazard of the mass gathering). All requirements were validated from the LEAs experts' perspective (one LEA from Ertzaintza and one from INTERNO). In the Table 20 a qualitative rationale for the assessment given to each PSD requirement is provided, together with the related level of acceptance (i.e. the mean value - between the two experts involved - of each requirement). All the requirements show a high level of acceptance.

Table 20: PSD – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
PMT_030 (PSD) The PSD	LEA expert	3	The PSD collect and put together several inputs to

tool will help LEAs to know the level of security hazard of the mass gathering during the event preparation.			assess the level of hazard of a mass gathering in a methodical way regardless of the place, the user or the time of completion. It provides a good result.
PMT_031 (PSD) The PSD tool will allow the user to introduce inputs related to the event, the venue, the crowd and intelligence.	LEA expert	2,50	The tool is designed with a form type format, with predefined answer options closed for each item. This method is adequate to standardize its use, however it could be possible that one particular event should consider one feature not included in the current design.
PMT_032 (PSD) The PSD tool will provide as outputs the indicator of security hazard (numerical value between 0 and 1 and a rating scale), the suggested security protocols and a summary report.	LEA expert	3	PSD provides security indicator and suggest protocols. They are flexible and can be tailored to end-user performances and criteria.
PMT_033 (PSD) The PSD tool should allow the possibility to save/open created event files.	LEA expert	3	PSD allows the user to save/open and create different event files.

4.2.6.4 General recommendations

The following suggestions were collected during the PD:

- To include the possibility in which the user can introduce an item that is not in the form and that is added in the evaluation;
- To include few inputs to characterize the event e.g. kind of event, threat, subject, audience, level of hazard.

4.2.7 Real-time evacuation tool (RTE)

Real-time Evacuation tool (RTE) allows LEAs to plan and know the potential evacuation times for crowds of at mass gatherings (e.g. fan-zone, stadium, venue of the celebration). It takes into account changing conditions of the emergency (escape route availability, evacuation strategy applied). This tool can be used both during the pre-event planning actions and the event execution.

Inputs to configure the model include: 1) number of people in the crowd, 2) number of escape routes, 3) width of escape routes, 4) distance from the crowd to the exits and 5) escape routes availability. The tool provides the following outputs: 1) 95th percentile of total evacuation times displayed on the screen, 2) optimal distribution of people per escape route displayed on the screen and 3) file of the evacuation study to be reloaded at any time. It uses Monte Carlo methods to model random evacuation process and assess the impact of evacuation strategies and exits availability due to the emergency.

The RTE was tested during the first PD in Bilbao, the main objectives were to:

- use the RTE tool during the pre-event(s) phase of MTV events for supporting ERT in security planning actions;
- use and test the RTE tool during event(s) execution;
- validate the RTE tool against a commercial evacuation model;

- interact continuously with the ERT and receive its feedback;
- define improvements for the RTE tool and define further actions for the second round.

Three participants were involved in testing the RTE: one superior inspector from INTERNO and two police officers from ERT and ADM.

The tool was also presented and tested during the last PD in Munich. Three police officers from the Bavarian police were involved. The main aim of this PD was to collect data to compare the simulation results with the evacuation times of the volunteers to be able to:

- 1) demonstrate how the simulation compares to the evacuation results;
- 2) calibrate the parameters of the simulation in the future.

During the PD in Munich the integration of the RTE tool with the LETSCROWD server was also tested.

The detailed descriptions of the validation exercises carried out during the practical demonstration are described in following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.7.2, 4.2.7.3 and 4.2.7.4.

4.2.7.1 Description of the validation exercise in PD1

The following table report the details of the validation exercise carried out to assess the first version of the real time evacuation tool.

Table 21: RTE – PD1 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of three researchers from the University of Cantabria.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>A manager from the UC: responsible for overseeing and planning the practical demonstration;</p> <p>A host from the ERT: member of staff in host LEA that has access/influence to the implementation of the PD and is sufficiently senior to liaise with those with overall responsibility for the event;</p> <p>An assistant from the UC: responsible for performing tasks identified by the Manager (M)- collecting and analysis the information of the events, configuring and running the PSD tool and providing results to ERT;</p> <p>3 Evaluators: 1 from ERT, 1 from INTERNO and 1 from ADM.</p> <p>LEAs personnel responsible for evaluating the RTE tool.</p>
TYPE OF EXERCISE	<p>TFX. Two kind of exercises were conducted:</p> <ul style="list-style-type: none"> • Pre-event <ul style="list-style-type: none"> ○ 4 small concerts from 29th October to 1st November, 2018 (Barakaldo, Getxo, Miribilla and Durango). Note that Getxo concert was cancelled due to bad weather conditions but it was indeed previously analysed. ○ Stellar concert at San Mamés Stadium on 3rd November, 2018 • Event execution <ul style="list-style-type: none"> ○ Stellar concert at San Mamés Stadium on 3rd November, 2018 (the exterior perimeter and the pitch). <p>WK. This workshop, conducted during the PD last 3rd November 2018, aimed to familiarize LEAs personnel (from ERT, INTERNO and ADM) with the RTE tool and allowed gathering suggestions and feedback for the outcome's improvements from an expert perspective.</p>

DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Pre-event:</p> <p>The RTE can provide results faster than real time (within a few seconds) but it can be also used for planning. Note that the RTE tool was previously validated against three commercial evacuation models (Pathfinder (12), STEPS (13) and MassMotion (14)) for a hypothetical mass gathering scenario. Evacuation results were compared providing relative errors in evacuation time predictions below 10 %.</p> <p>For the PD the RTE tool was also applied to the following mass gathering events in advance (two weeks before):</p> <ul style="list-style-type: none"> • Barakaldo concert 29th October • Durango concert 30th October • Getxo concert 31st October (analysed before being cancelled due to bad weather conditions) • Bilbao-Miribilla concert 31st October • San Mamés concert 3rd November <p>ERT provided information of the MTV events to UC. The information was analysed, and the evacuation scenarios were defined together by UC and ERT. For each event a base scenario (all exits available) and what if scenarios (some exits unavailable due to hypothetical emergencies) were configured for the simulations. Simulations were conducted in parallel with RTE tool and Pathfinder. A PPT with the inputs and the evacuation results for each event was sent by UC to ERT as support for security planning actions (11). An example of PPT provided for the Barakaldo concert is shown in section 12 - ANNEX F.</p> <p>Event execution:</p> <p>The RTE tool was explained to each LEA personnel involved in the PD and directly run for the analysis of the Stellar Concert in San Mamés Stadium. The demonstration was focused on the pith where there were around 12.500 spectators. Input parameters were varied assuming different hypotheses required by ERT personnel making exits unavailable allowing exploring different evacuation procedures.</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	A short demonstration running the software in a laptop was conducted during the PD.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A.
OTHERS GENERAL NOTES AND COMMENTS REGARDING THE EXECUTION OF THE PD	ERT collected video-recordings of people movement in normal conditions deemed to be used for further validation of the tool.

Table 22: RTE – PD5 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	Two members of UC participated in the data collection and were present to help demonstrate the tool, take notes and answer questions. One, a software developer, the other an evacuation human behaviour expert.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>Multiple police officers were present during the demonstration:</p> <ul style="list-style-type: none"> • Two officers from Bavarian Police University - one is teacher for operational management, the other for assembly and intervention right

	<ul style="list-style-type: none">One officer from Bavarian State Criminal Police – member of the project group “video surveillance”												
TYPE OF EXERCISE	<p>The exercises consisted of testing the functionality of the RTE tool the day after the experiments when basic inputs were known (i.e. number of participants), but also a focus group to demonstrate the functions and comparison between the actual evacuation during the experiments and the previously simulated one.</p> <p>The RTE tool integration with the LETSCROWD Server was confirmed as well.</p>												
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Multiple small exercises were carried out in indoor and outdoor scenarios with a set of 54 volunteers to test:</p> <ul style="list-style-type: none">- Evacuation- Evacuation with routes closed <p>This was simulated in advance and a day after the volunteer exercises. A use case observed during the experiments (outdoor scenario with two available exits) was shown during the presentation of the tool to the LEAs. The predicted evacuation times were very close than the observed during the experiments.</p> <table><tr><th colspan="3">Evacuation times (s)</th></tr><tr><th>Exits (% use)</th><th>Exercises</th><th>RTE tool Mean [min-max]</th></tr><tr><td>1 (80)</td><td>25</td><td>25 [20-32]</td></tr><tr><td>2 (20)</td><td>37</td><td>35 [30-42]</td></tr></table>	Evacuation times (s)			Exits (% use)	Exercises	RTE tool Mean [min-max]	1 (80)	25	25 [20-32]	2 (20)	37	35 [30-42]
Evacuation times (s)													
Exits (% use)	Exercises	RTE tool Mean [min-max]											
1 (80)	25	25 [20-32]											
2 (20)	37	35 [30-42]											
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	n/a												
CRITICAL ISSUES ARISEN DURING THE EXERCISE	<p>The reduced number of participants was a challenge for the RTE tool predictions as it is intended for large crowds. However, this PD5 demonstrated the capabilities of the RTE tool to predict even such conditions.</p>												

4.2.7.2 Validation questionnaire results

The following sections will report the main results collected during the PD1 in Bilbao and PD5 in Munich. Results collected through the validation questionnaire and the debriefing template will be discussed together.

4.2.7.2.1 Usefulness

Most of the participants considered the tool very useful (Figure 49). It allows estimating the evacuation time of a venue/space in case of emergency and it could be used for the planning phase or even during the event assessing different scenarios in real time.

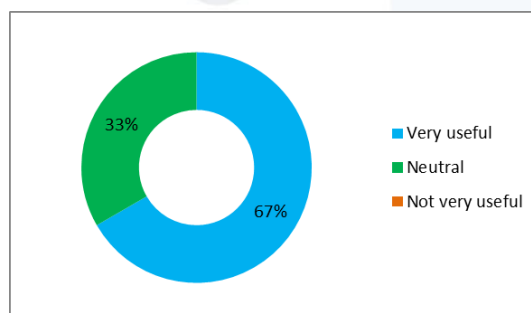


Figure 49: Usefulness RTE - Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

Among the others, the features considered most important by the LEAs were the following:

- Its manageability and the possibility of working in real time (modifying parameters from incidents that may occur);
- the possibility to represent the plan of the location and to see how the crowd can behave in a given different options (exits unavailable and opening and closing exists to see the differences);
- the possibility to simulate different evacuation and protection scenarios, providing relevant information for decision making, with a scientific basis;
- the possibility to work on real time.

4.2.7.2.2 Usability

The SUS mean value was 75.6; this means that the tool was considered usable the majority of the participants. The individual SUS scores are reported in the figure below.

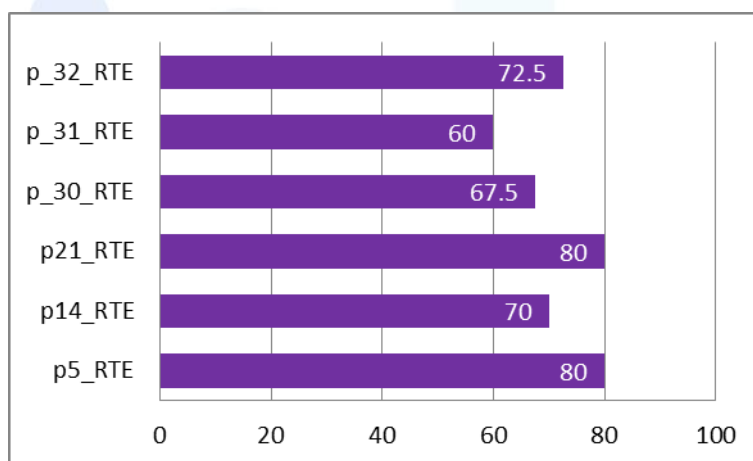


Figure 50: RTE - Individual SUS scores

The qualitative feedback collected through the debriefing highlighted that the participants felt confident in using the tool, the data were easy to enter and the graphical interface was intuitive and easy to understand.

Even if the tool was considered easy to use, the participants reported that a small user manual would be useful to support the users in learning its main functions.

In general the main components of the tool were considered well integrated.

4.2.7.2.3 Effectiveness and Compatibility

Most of the experts involved in the assessment thought that they would be able to effectively complete their working activities by using the tool (Figure 51).

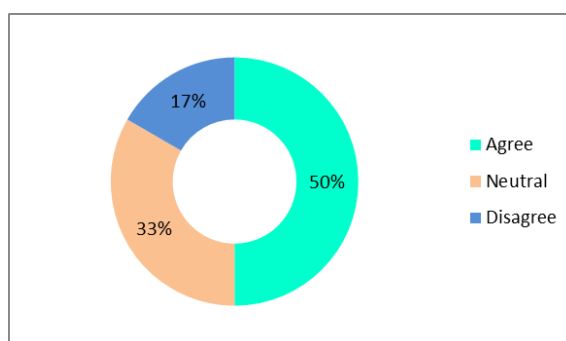


Figure 51: RTE effectiveness scores - I can effectively complete my work using this tool

The majority of the participants agreed that the real time evacuation tool is compatible with the current practices (see Figure 52 and Figure 53). One expert highlighted that there are no other similar tools available within their organisation and, thus the tool would be very useful for police forces. The tool seemed also applicable in realistic situation; one police officer from Erzaintza reported that they are using it to verify the validity and suitability of some interventions in the field.

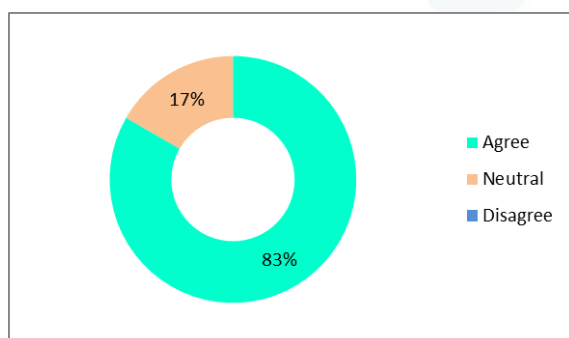


Figure 52: RTE compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

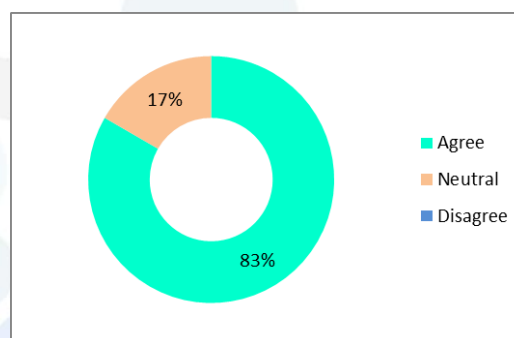


Figure 53: RTE compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.7.2.4 Maturity

The figure below shows the RTE maturity levels scores. The participants rated the tool between TR5 and 6, this means that the main components of the tools are well integrated; the tool seems likely ready to be used in real operational environment. One expert mentioned that even if the tool is mature it is always better to test it through simulated exercises before using it in real situations.

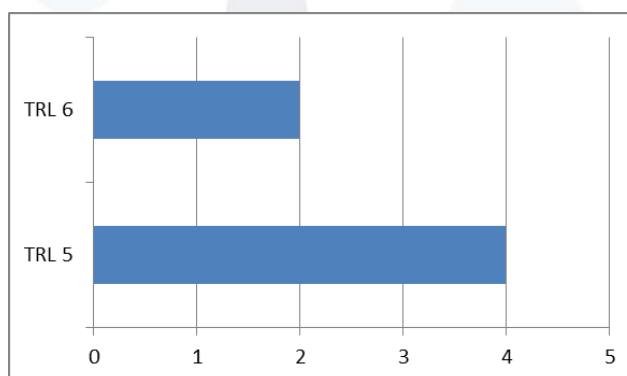


Figure 54: RTE maturity level scores

4.2.7.3 Requirements acceptance scales

The RTE requirements are included in the CMPT requirement list (see D2.1) because this stochastic model designed to calculate the evacuation times in mass gathering events is one of the models to which CMPT refers. However, RTE can be applied also as a tool per se. That is why it has been singularly validated in the PD1 where the CMPT was not validated and as part of the CMPT in PD5 when the requirements of the crowd model tool were assessed. In both cases requirements were validated from the LEAs experts' perspective. In PD1 two experts were involved (one LEA from Ertzaintza and one from INTERNO), while three LEA officers participated in the requirement validation in PD5. In the Table 23 a qualitative rationale for the assessment given to each PSD requirement is provided, together with the related level of acceptance (i.e. the mean value – among five experts involved - of each requirement). All the requirements show a high level of acceptance.

Table 23: RTE – Requirements validation

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
CMP_014 (RTE) The Real-time Evacuation tool will offer results as fast as the phenomena requires.	LEA expert	3	RTE provides ready answer to inputs in a few seconds. It shows results very fast. Maybe the simulation runs faster than real time.
CMP_017 (RTE) The Real-time Evacuation Tool will allow the user to explore different emergencies.	LEA expert	3	RTE allows simulating evacuation based on different variables (number of people, evacuation routes, blockages, etc.). There are also foreseen several situations that could arise and happen during a real event.
CMP_019 (RTE) The Real-time Evacuation Tool should be used for buildings and outdoor locations with defined entrances/exits.	LEA expert	3	RTE allows building indoor and outdoor locations for simulations. A variety of emergencies can be simulated.

4.2.7.4 General recommendations

Based on the feedback gathered from the experts involved in the PDs some general recommendations can be derived. The main suggestions arose during the debriefing sessions were the following:

- Include a user manual in order to facilitate users in learning the main functions of the tool;
- Make the help button more visible.

In general the tool seems to be useful and its integration with other more complex planning tools could be a real benefit for LEAs. Ideally information about different events areas should be stored in a repository to be able to get the required input faster. In the case of an emergency the necessary information has to be available directly (and fast) for the commanding officer.

4.2.8 Semantic Intelligence Engine (SIE)

The Semantic Intelligence Engine (SIE) allows gathering and monitoring information published in the Web about a mass gathering before and during a given event. This tool enables the security analysts to filter out a potentially huge amount of related information about an event that is irrelevant from a security point of view, allowing them to focus their analysis on a subset of web resources identified by the tool.

The semantic Intelligence Engine tool was assessed three times in PD1 (Bilbao), PD2 (Rome) and PD5 (Munich), with a total of 6 experts involved.

The first PD in Bilbao and the second one in Rome aimed to test the usefulness and usability of a first release of the SIE from the users' perspective. The main features tested were the following:

- Overall usability of the integrated tool (Web Crawler and Cogito Intelligence);
- Dashboard usability;
- Researches' results filtering and search functionality;
- Text Analysis' result diagrams and statistics (i.e., entities extracted including people, places and organizations, and taxonomies used to classify the Web resources, sentiment analysis, taxonomies).

Moreover some specific features of the semantic intelligence engine were also tested during the PD5 in Munich including the alarm system that allows configuring alarms and receiving notifications and the provision of anonymized author information). The aim of this activity was to validate a set of requirements that were not included in the Bilbao and Rome PD (see Table 26).

The detailed descriptions of the validation exercises carried out during the practical demonstrations are described in the following sections. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.8.2, 4.2.8.3 and 4.2.8.4.

4.2.8.1 Description of the validation exercises in PD1 (Bilbao), PD2 (Rome) and PD5

The following tables report the details of the validation exercises carried out to assess the first release of the semantic intelligence engine tool.

Table 24: SIE – PD1 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of one person from Expert System that leaded the PD and collected the validation data.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	2 Participants took part in the PD: 1 Agent/Officer of ERZAINZA; 1 Agent/Officer from INTERNO.
TYPE OF EXERCISE, e.g.:	<ul style="list-style-type: none"> • Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>First the technical provider made a short presentation introducing the tool to the participants. In this introduction participants were asked to sign the IFC formulary. Next, a user manual and a test case were handed to the security analysts with a list of tasks that needed to be executed with the support of the tool. Each time the security analysts performed successfully a task or a list of tasks, a requirement was assessed. At the end of the test case, a debriefing session was carried out to summarize the PD and gather conclusions.</p> <p>(The detailed description of the PD1_SIE test case is reported in section 10 - ANNEX D).</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	<p>Communication between the technical provider and the LEA was established before the PD via e-mails and conference calls to ensure that the minimum requirements for the successful execution of the PD and the gathering of data required for the tool setup (e.g., keywords to configure the web crawler, and web pages of interest) would be reached.</p> <p>Expert System and Pluribus One deployed the SIE components on the Web and</p>

configured them according to the LEA input.

CRITICAL ISSUES ARISEN DURING THE EXERCISE N.A.

Table 25: SIE – PD2 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of two people from Expert System and Pluribus One with the role of moderator and note taker.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>3 participants took part in the PD:</p> <ul style="list-style-type: none"> • 1 Agent/Officer of the ERZAINZA; • 2 Agents/Officer of the CNAIPIC (Centro nazionale anticrimine informatico per la protezione delle infrastrutture critiche) LEA for INTERNO.
TYPE OF EXERCISE	<ul style="list-style-type: none"> • TFX – Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>Participants were asked to execute different <i>test cases</i> under the guideline of a technology provider mediator. Each test case focused on the testing of a specific SIE feature or set of features. After the execution, each participant was asked to provide his opinion about the usability and usefulness of the SIE tool in their working activities. Each test case was carried out as follows:</p> <ul style="list-style-type: none"> • The technological provider mediator described the use case scenario and explained its execution; • The ERZAINZA Agent/Officer executed the task; • The CNAIPIC Agent/Officer for INTERNO executed the task; • Both Agents/Officers assessed the specific tool feature associated to the use case. <p>Note: These steps were followed for each test case.</p> <p>After this initial phase, a plenary discussion lasting 30min was carried out. The discussion has been guided by the <i>debriefing template questions</i>.</p> <p>(The detailed description of the PD2_SIE test case is reported in section 10 - ANNEX D).</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	A short presentation of the SIE tool, of its main components and of the available sources of information and researches was carried out through a PPT presentation. A working version of the SIE tool was hosted and made available for testing purposes.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A.

Table 26: SIE – PD5 description of the validation exercise

DESCRIPTION OF THE VALIDATION TEAM	The validation team was composed of a technology expert from Expert System that covers all the aspects of the validation.
PARTICIPANTS (ROLES AND RESPONSIBILITY).	<p>1 participant took part in the validation:</p> <ul style="list-style-type: none"> 1 Agent/Officer of the ERZAINZA LEA that attended the Munich demonstration. This Agent/Officer was part of the Rome demonstration and therefore knew beforehand the tool and we could focus on the new features that were going to be validated.
TYPE OF EXERCISE	<ul style="list-style-type: none"> TFX – Technical and functional exercises
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>First a presentation of the tool was carried out. Then a test case specially prepared for validating the alarm mechanism and the availability of the anonymized author information was handed to LEA officer.</p> <p>The test case comprises different tasks that were accomplished by the LEA officer and the technology provider. After a successful execution of a task in the test case the LEA officer was asked to validate one or more related requirements.</p> <p>(The detailed description of the test case is reported in section 10 - ANNEX D).</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	<p>A brief presentation of the SIE tool and its main components was done to all the Munich PD attendees.</p> <p>A working version of the SIE tool was deployed and made available for testing purposes for the participants.</p> <p>We used the “Munich Security Conference 2019” as the event to analyse in this PD. We configured the web crawler to gather news about this event in German and English that were published in the European Union. The event took place from the 15 to 17 Feb, 2019.</p> <p>Finally, we prepared a test case with clear tasks that serves as a reference for the LEA participant to validate the tool requirements.</p>
CRITICAL ISSUES ARISEN DURING THE EXERCISE	N.A.
OTHERS GENERAL NOTES AND COMMENTS REGARDING THE EXECUTION OF THE PD	The LEA officer was aware of why the author information was anonymized in the context of the project due to the GDPR restrictions that affects to technology providers, even though LEAs have a different regulation. The tech provider explained that the author information was gathered only from Web Sites where this information was explicitly defined in the metadata so that other systems can find it. Thus, the author information is only captured for these web sites. We capture the author name and apply a numerical function to anonymize it.

4.2.8.2 Validation questionnaire results

The following sections will report the main results collected in both PD1 (Bilbao) and PD2 (Rome). After the execution of each validation exercises (see previous the section), participants were asked to fill-in the

validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.8.2.1 Usefulness

In general, the tool was considered very useful for supporting social network analysts in gathering and monitoring information published in the Web about a mass gathering before and during a given event (Figure 55).

Only one expert rated the tool as not very useful because a social network of interest was not supported in the SIE due to limitations imposed in the social network terms of use. However, the potential of the tool is recognized since it allows gathering data from social networks that are being more and more used (e.g., Reddit) in the world.

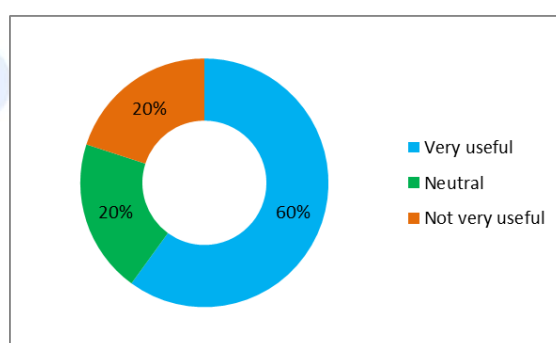


Figure 55: Usefulness SIE - Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

The features and components rated as most relevant and important for the users were:

- the wide range of search criteria, the response speed, and the possibility to see the original web resource;
- the Geolocation and the validity of the sources monitored. As highlighted by one expert they are both important to establish the provenance of a piece of information. The fact that the information comes only from reliable sources (which have been eventually indicated and selected by the operator) represents an added value.
- the configurable crawler, key word filter, time and time series filter, sources filter because these features can improve the efficiency of the social network analysts' tasks.

Regarding the features less appreciated or that would need an improvement, one expert reported that the taxonomy display, although important, is not as relevant as other features.

4.2.8.2.2 Usability

The SUS score mean value for the SIE was 72.5. This means that the overall usability and comprehensibility of the tool was considered good by all the experts involved in the evaluation. The figure below shows the individual SUS scores.

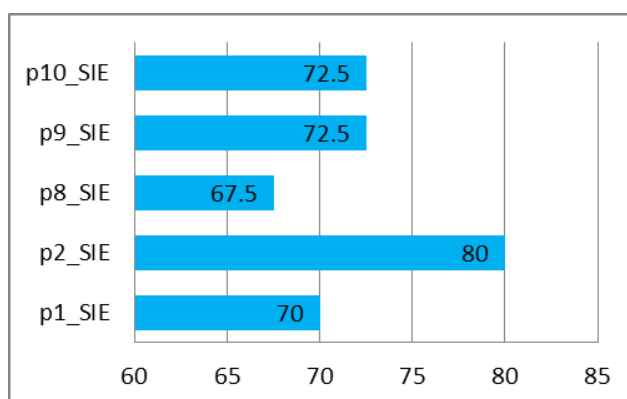


Figure 56: SIE - Individual SUS scores

All the participants agreed that they would like to use the tool frequently; one of them reported that the SIE can improve the quality of the investigations and make them more efficient timewise. All the experts reported that:

- The tool was easy to use and the graphical user interface was really clear.
- The tool was easy to learn; only few information was required for using it. Being the first time practicing with the tool, experts stated that they felt confident in using it. In particular, the graphical interface was considered very friendly and intuitive.
- All the components seemed well integrated. During the PD in Rome one of the analysts reported that the main lack in terms of integration is represented by the fact that the search configuration panel was not available in the current release of the tool. The possibility to customise the search options, selecting the sources, the keywords, and the frequency of the search represents a crucial step in the development of the activity.

4.2.8.2.3 Effectiveness and Compatibility

Most of the participants reported that they could use the tool to effectively complete their working activities without discarding the current procedures and investigative methods. Only one expert stated that the tool was not effective because, at the time of the practical demonstration in Bilbao, the semantic engine tool did not cover the data sources currently used by the analyst.

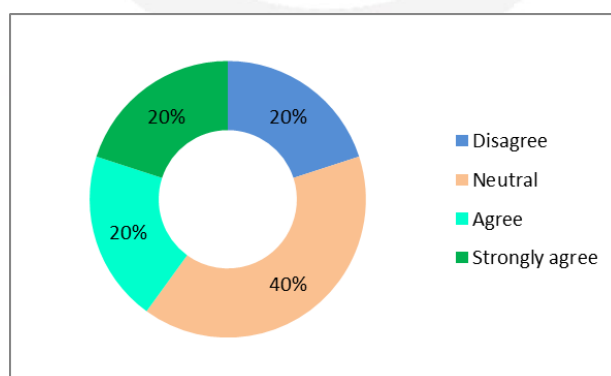


Figure 57: SIE effectiveness scores - I can effectively complete my work using this tool

Regarding the compatibility of the tool with the operational procedures currently in place (Figure 58) and its applicability in real situations (Figure 59), the majority of the experts agreed that the tool has the potential to support them in carrying out their tasks by complementing some of their current methods and

practices.

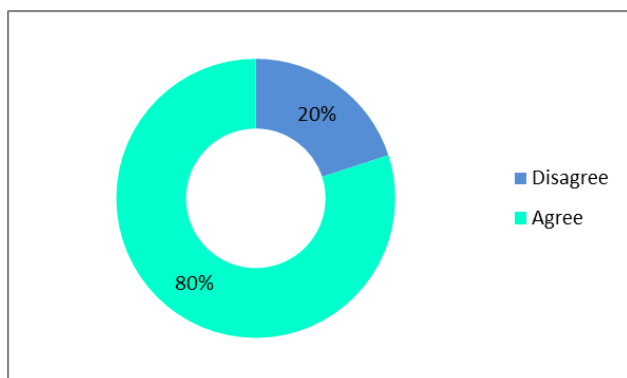


Figure 58: SIE compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

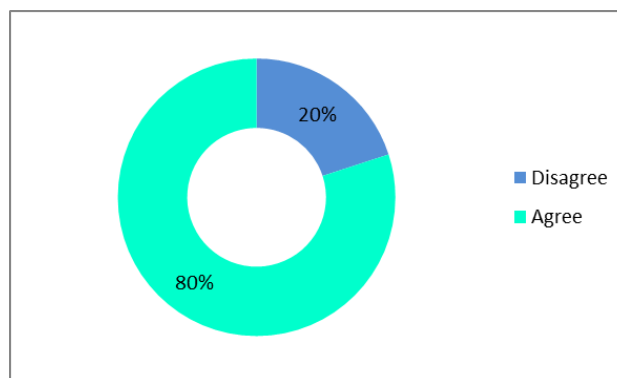


Figure 59: SIE compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.8.2.4 Maturity

The figure below shows the SIE maturity level scores. Four participants out of five rated the tools between TR5 and 6, this means that the main components of the tools are well integrated; the tool seems likely ready to be used in real operational environment. Nevertheless, some LEAs suggested that some further improvements are needed to be adopted in operational situations.

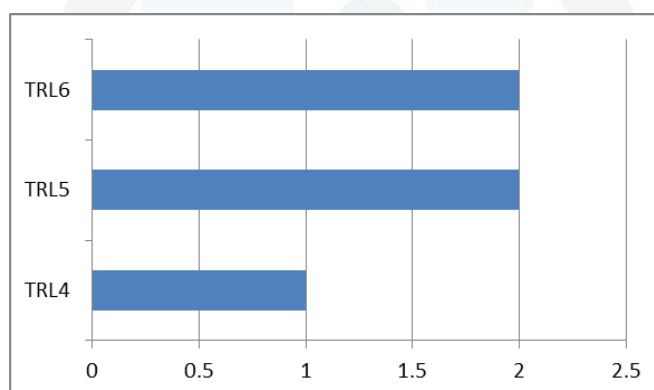


Figure 60: SIE maturity level scores

4.2.8.3 Requirements acceptance scales

Among the SIE requirements, nine of them (i.e. SIE_001, 002, 003, 004, 006, 008, 009, 010, 013) have been updated (see section 9- ANNEX C) with respect to the D2.1.

In PD1 and PD2, the technology provider defined a test case (see section 10 - ANNEX D) with a list of tasks to be carried out by the LEA officers with the support of the tool. The list of tasks was designed to be useful in the real monitoring of web information for an event and to allow validating the requirements of the tool while carrying out specific tasks. All participants were asked to fill in the requirements acceptance scale following the test case. The majority of the requirements were validated from the user' perspective, while few others (i.e. SIE_006, 008, 009, 010, 012, 013) from the technology provider's point of view. This last one assessed those requirements not covered in the PDs since they referred to SIE features and functionalities not yet developed. Four LEAs experts have been involved in the requirements validation, i.e.: 1 LEA officer from Ertzaintza in the PD1; 1 LEA officer from Ertzaintza and two experts from INTERNO/ CNAIPIC in the

PD2.

An overview of the requirements level of acceptance in PD1 e PD2 is shown in the below.

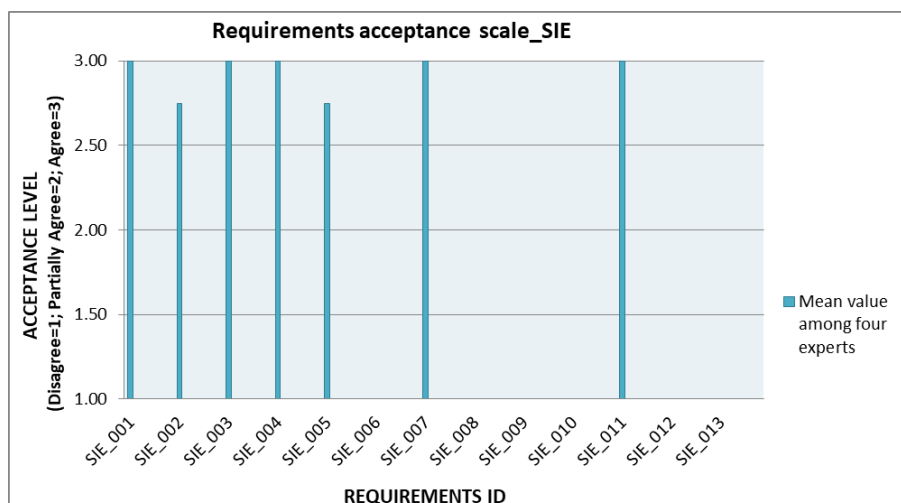


Figure 61: SIE – Requirements assessment scale results (PD1 and PD2)

In the Table 27 a qualitative rationale for the assessment given in PD1 and PD2 to each SIE requirement is provided, together with the related level of acceptance (i.e. the mean value - between the four experts involved - of each requirement).

Table 27: SIE – Requirements validation in PD1 and PD2

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
SIE_001 The tool will allow the gathering of information from social media platforms, web sites and other web sources according to users' needs and within the boundaries of sources' Terms of Service.	LEA expert	3	SIE showed data gathered from the web and social networks, also according to the web crawler configuration (in PD2).
SIE_002 The tool will allow parameterizing the system including the Web Crawler and the Semantic Analysis module.	LEA expert	2,75	In both PDs, SIE was parameterized with the data sources and keywords of interest for the events to which PDs referred (i.e. the MTV Event in PD1 and the Champions League Match in PD2).
SIE_003 The tool may allow filtering geospatially of the collected messages according to their associated location whenever it is available or can be inferred.	LEA expert	3	The SIE dashboard has a location filter used to drill-down on data on a specific location.
SIE_004 The tool will provide indicators summarizing the semantic analysis (sentiments and vocabulary) including messages where security measures are mentioned, by discriminating the event phase.	LEA expert	3	The SIE dashboard provides all this information and allows the visualization of the semantic indicators.
SIE_005 The tool will provide a detailed view of the messages	LEA expert	2,75	At the bottom of the SIE dashboard, a panel allows inspecting data in detail,

including its provenance information and different categories identified by the semantic analysis.			including messages.
SIE_006 The tool will provide the source of the web content and the “author” as it appears in the web content. The tool considers as “author” the one provided by the source of information (e.g., the author as reported on a web page, a user on a social media platform, etc.) and cannot automatically associate it to a physical person.	Technology provider	1	This requirement was not validated since this feature was still immature when PD1 and PD2 were carried out.
SIE_007 The tool will provide a semantic search engine where messages can be found according to their content and categories obtained by the semantic analysis.	LEA expert	3	SIE provides different search options in the dashboard: keyword, dates, time series and many other criteria.
SIE_008 The tool must provide a functionality to export/save the result of the information gathering and semantic analysis in an information unit called “crowd event object”. Legal compliancy may limit and reduce the amount of information that can be exported/saved.	Technology provider	1	This requirement was not validated since this functionality was still immature when PD1 and PD2 were carried out.
SIE_009 The tool must provide a search engine of crowd event objects. A crowd event object holds the result of the information gathering and data analysis for a past event.	Technology provider	1	This requirement was not validated since this functionality was still immature when PD1 and PD2 were carried out.
SIE_010 The tool must allow browsing the information contained in a crowd event object. A crowd event object holds all the data gathered and analysed for a past event.	Technology provider	1	This requirement was not validated since this functionality was still immature when PD1 and PD2 were carried out.
SIE_011 The tool will be first in English, and then translated into other languages after its reliable.	LEA expert	3	SIE supports text in English, Spanish and Basque.
SIE_012 The tool must allow configuring and sending alarms based on the output of the semantic analysis task.	Technology provider	1	This requirement was not validated since this functionality was still immature when PD1 and PD2 were carried out.
SIE_013 The tool may provide a suggestion regarding the possibility that a message has been written by a “bot” instead that by a human being.	Technology provider	1	This requirement was not validated since this functionality was still immature.

In the PD5 only the requirements that were not assessed in the PD1 and PD2 were evaluated by the same LEA officer involved in the SIE validation carried out in PD1, i.e.: SIE_006, SIE_008, SIE_009, SIE_010, SIE_012, SIE_013. Also in the PD5 a test case (see section 10 - ANNEX D) has been applied to validate these requirements while the LEA expert was carrying out specific tasks. Except for the requirement SIE_013 that was defined as optional due its low priority and not yet developed, all of the requirements listed above have collected the high level of acceptance from the LEA officer (i.e. Agree=3), as summarized in the table below.

Table 28: SIE – Requirements validation in PD5

Requirement ID and description	Type of validator	Level of acceptance (1=low; 2=medium; 3=high)	Assessment rationale
SIE_006 (see description above)	LEA expert	3	The information about the author is anonymized with a code.
SIE_008 (see description above)	LEA expert	3	In the PD5, results were not exported but, rather, saved.
SIE_009 (see description above)	LEA expert	3	SIE provides a search engine of crowd event objects.
SIE_010 (see description above)	LEA expert	3	SIE allows browsing the information contained in a crowd event object.
SIE_012 (see description above)	LEA expert	3	SIE allows configuring and sending alarms based on the output of the semantic analysis task.
SIE_013 (see description above)	Technology provider	1	This requirement was not validated since this functionality has not developed yet.

4.2.8.4 General recommendations

Based on the feedback gathered from the experts involved in the PDs some general recommendations can be derived. The main suggestions that arose during the debriefing sessions were the following:

- It would be useful to enable the operator to freely configure the crawler on his own.
- It would be worth to implement three set of tools for social media analysis like Facebook, Twitter and Instagram.
- Include the possibility to customise the search options, selecting the sources, the keywords, and the frequency of the search represents a crucial step in the development of the activity.
- LEAs are looking forward to see the integration of this tool as a support for the dynamic risk calculator.

These recommendations are the basis for the development of the forthcoming SIE features. The Web Crawler will include a user interface integrated with the rest of the SIE that enables LEA operators configure and execute data searches according to the event that is being monitored. The configurations options will include the sources of data and the keywords used to filter the data to retrieve. On the other hand, is important to note that some social media like Facebook and Twitter impose barriers to technology providers in their licenses or terms of use regarding the use of their data for entities related to governments or for surveillance purposes. Hence in the context of the project we will not include them as data sources for the Web Crawler. Nevertheless, Instagram does not impose these limitations and hence

the development of a plugin to retrieve data from this data source is planned.

4.2.9 LETSCROWD server

The LETSCROWD server is a platform that aims to integrate the information provided by the different LETSCROWD tools in order to have a single resource of information for monitoring an event. The tool is deemed to be related with all the (technical) outcomes of the project. It has been developed using the most modern web technologies such as Node.js, meteor, Blaze and MongoDB.

The LETSCROWD Server stores the main information of the system in a database, which contains information related to events, signals, policies and venues. It receives information from the external modules (e.g. crawling - SIE, crowd information CMPT and video information - HCV) and stores it as signals. The LETSCROWD server is composed of two main modules: 1) the Dynamic Risk Assessment for evaluating the risk level of the event based on the event information and the information coming from the signals, and 2) the PMT (Policy Making Toolkit) for evaluating which policies defined in the database are valid or not for an given event.

A preliminary integration of the LETSCROWD server was tested during the PD5 in Munich. The main aim of the validation was to:

- Collect LEAs' feedback on the usability of the tool;
- Test if the different tools of the project, which were developed separately work well together in the platform.

Two police officers and one police officer at university for public service from the Bavarian police were involved in the validation process.

The detailed description of the validation exercise carried out during the practical demonstration is described in following section. While the analysis of the results gathered through the validation questionnaire, the debriefing template and the requirement acceptance scales are described in sections 4.2.9.2,

4.2.9.1 Description of the validation exercise in PD5 (Munich)

The following table report the details of the validation exercise carried out to assess the preliminary integration of the LETSCROWD server.

Table 29: LETSCROWD server – PD5 description of the validation exercise

SHORT DESCRIPTION OF THE TOOL AND THE MAIN COMPONENTS ASSESSED	The Letscrowd server shows information related to a specific event, which is going to be monitored. It also provides information about the venue, policies and weak signals (suspicious information sent by LEAS) related to the event. It permits to include multimedia information. It also has two main modules for evaluating the risk of the event (DRA) and for evaluating the policies in the event (PMT). It finally shows information from the CMPT, SIE and HCV for a specific event.
DESCRIPTION OF THE VALIDATION TEAM	<p>A project manager from ETRA, was responsible for demonstrating the tool, take notes and answer questions from the LEAs.</p> <p>Two software developers from ETRA, collecting and filling out the information of the event, configuring and running the tool and proving the</p>

	result to the LEAs.
PARTICIPANTS (ROLES AND RESPONSIBILITY)	<p>Three police officers were the participants in this PD. They had different roles and responsibilities within their own organisation:</p> <ul style="list-style-type: none"> • One university for public service • One police officer (working on face recognition) • One police officer
TYPE OF EXERCISE	<p>TFX - technical and functional exercises</p> <p>The exercises consisted of testing the functionality of the main features of the separate tools within the LETSCROWD server. Some technical problems arose with the HCV. Once the full application will be developed, there will be a real event in which all the features of the application will be tested where it will provide real information of the LEAs and will be included in the LETSCROWD database and will be used to test the internal modules.</p>
DETAILED DESCRIPTION OF THE TYPE OF EXERCISE CARRIED OUT	<p>The PMT module was tested by the insertion of several laws related to the event and was saw whether these laws worked correctly. The other functionality was tested by sending signals to the LETSCROWD Server, adding multimedia information. There was shown the information received by the other tools as crawling information (SIE), crowding information (CMPT) and video information (HCV).</p> <p>The messaging tool was tested sending multimedia information as images or videos. The DRA module will be tested in future events by the insertion of many signals related to the information of past and actual event.</p>
PREPARATORY TRAINING ACTIVITIES, IF CARRIED OUT	The LETSCROWD server was showed the day after the PD explaining its different components. After this introduction, LEAs from BayHfoeD used it in order to provide their feedback.
CRITICAL ISSUES ARISEN DURING THE EXERCISE	The critical issue is the use of HCV in real time. The original idea was to access the LEAs video recorders and send this information to the LetsCrowd Server as a signal. As the HCV tool could not have access to the CCTV systems of LEAs, a video server has been implemented and all the videos were displayed from this server.

4.2.9.2 Validation questionnaire results

The following sections will report the main results collected during the PD1 in Bilbao. After the execution of the validation exercise (see previous section), participants were asked to fill-in the validation questionnaire and to participate to the debriefing session to collect qualitative feedback. Results gathered through the validation questionnaire and the debriefing template have been discussed together.

4.2.9.2.1 Usefulness

The three experts rated the tool as neutral.

The participants stated that the tool would be useful only if the information is provided automatically: *“It is required a minimum of 3 LEA’s in order to tackle the information provided by the different tools, so if the tool can provide the information without being consulting the different tools separately then it is useful”*.

All the participants agreed that the most important feature of the tool is the capability to combine the information provided by the other tools and the possibility to select the information that LEAs are looking for.

On the other hand, LEAs thought that there is a lot of information to process for a single user before taking a decision. For this reason it is important to improve the usability of tool by simplifying the information and signals received from the different tools.

4.2.9.2.2 Usability

The SUS score mean value for the LETSCROWD server was 48.3, below the general average of the scale. The individual SUS scores are shown in the figure below.

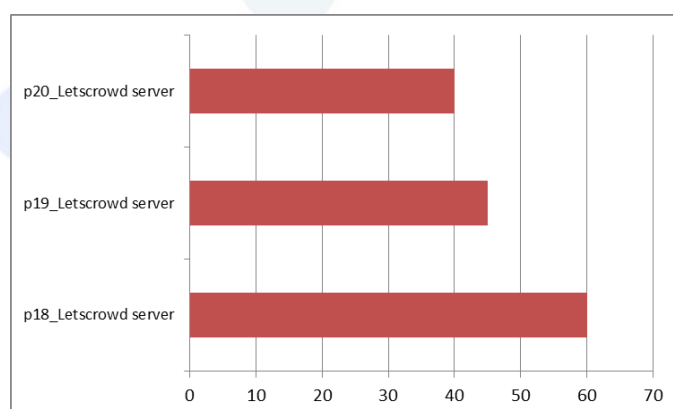


Figure 62: LETSCROWD server – individual SUS scores

All the experts agreed that the LETSCROWD server could be helpful only for big events because it supports the collection of information throughout the different phases of an event (before, during and post) and it would be useful to track the history of the event.

While using it for small events would be useless because it would require a strong effort in managing the information coming from the different tools.

At the time of the PD, the tool was considered not easy to use because the information visualised was chaotic and not easy to find. In order to be able to properly use the tool, LEAs would need to be trained in advance. All the LEAs thought that after a short training session, they would be able to easily operate the tool because it is all automatized.

Finally, all the participants agreed that the person who would be responsible for handling the platform should be able to process the information quickly. In the event preparation phase, there is no problem to spend more time filling out the information regarding an event, but during the event the information has to flow very quickly.

4.2.9.2.3 Effectiveness and compatibility

Most of the participants thought that the tool was effective in supporting LEAs to take decisions when organising and managing a mass gathering. However, despite the information is provided automatically, it is required a minimum of 3 LEA's in order to tackle the information provided by the different tools.

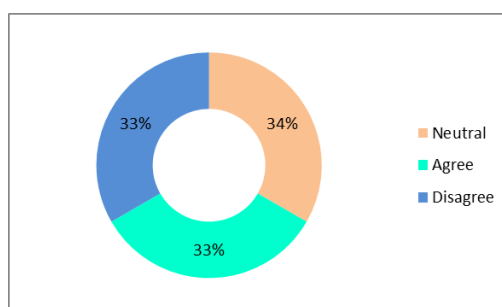


Figure 63: LETSCROWD server - I can effectively complete my work using this tool

All agreed that the LETSCROWD tool would be compatible with existing tools and operational procedures. To be realistically applicable within an organization, most of the participants agreed that the tool requires a better correlation among the different components of the platform.

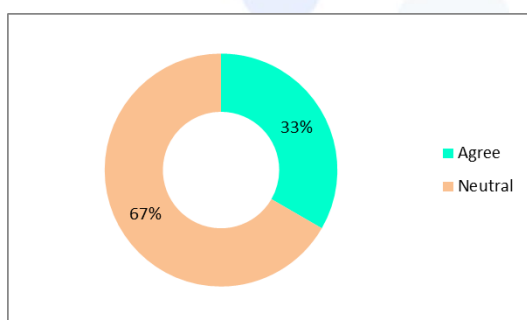


Figure 64: LETSCROWD server - compatibility scores - I believe that this tool is compatible with procedures already existing in my organisation

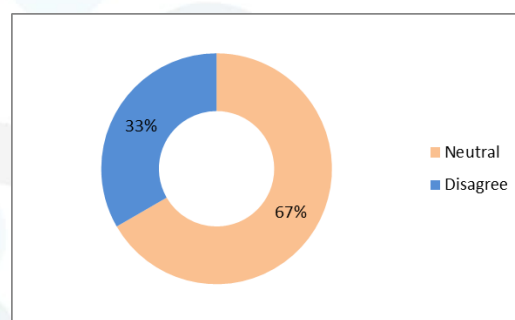


Figure 65: LETSCROWD server - compatibility scores - I believe that this tool is realistically applicable in my organisation

4.2.9.2.4 Maturity

The figure below shows the LETSCROWD tool maturity level scores. All the experts rated the tool as TRL 4 this means that the basic components of the tool work together. However, as mentioned above the tool would require a better integration among its main components.

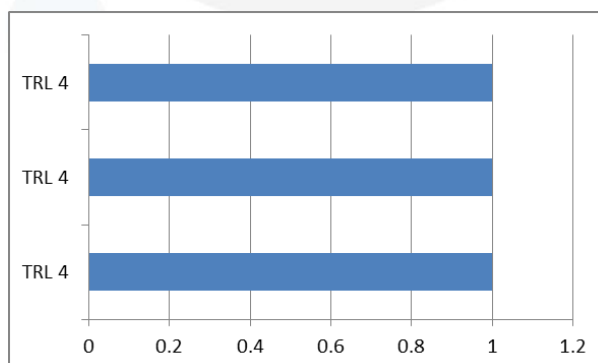


Figure 66: LETSCROWD tool maturity level scores

4.2.9.3 Requirement acceptance scales

The LETSCROWD server is composed by the Policy Making Toolkit plus the data provided by the other

LETSROWD tools, i.e.: CMP, RTE, SIE, and HCV. No specific requirements for the LETSCROWD server were identified since the main purpose of its validation in PD5 was to check if data provided by the other LETSCROWD tools could be integrated in the platform.

4.2.9.4 General recommendations

Based on the feedback gathered from the experts involved in the PDs some general recommendations can be derived. The main suggestions arose during the debriefing sessions were the following:

- In general LEAs thought that there is a lot of information to process for a single user before taking a decision. For this reason it is important to improve the usability of tool by simplifying the information and signals received from the different tools.
- The information received when an incident happens must be configured more quickly in order to take the right decisions in a few seconds.
- Even though a single platform would be able to process a huge amount of information, it is still necessary to compare the information provided by the different tools with the reality in order to be confident with the information provided by the different sources.

5 Conclusions

The D6.3 describes the overall validation process and methodological approach adopted to assess the LETSCROWD outcomes in the first cycle of practical demonstrations. For this purpose a specific validation toolkit has been set up. It includes several instruments, i.e. the validation questionnaire, the debriefing template and the requirements acceptance scale. This validation approach is based on the principles of the *Human centred design approach* (HCD) that aims to integrate users' perspective into the tools development. In this iterative approach usually a *formative evaluation* is distinguished from a *summative* one. The *formative evaluation* allows mainly identifying usability problems concerning LETSCROWD outcomes' efficiency, effectiveness and satisfaction from the end-user perspective to be improved and solved before the final release of the tools.

D6.3 reports the main results of the LETSCROWD outcomes validation carried out in the first cycle of practical demonstrations. Also specific recommendations for the enhancement of each tool have been identified as part of the formative evaluation.

Five different PDs were organized through the LEAs involvement, i.e.:

- PD1 (3.11.2018) - held in Bilbao during the Music Week MTV EMAs 2018. It was organised by Ertzaintza with the support of ETRA, Expert System, University of Cagliari and University of Cantabria.
- PD2 (26-27.11.2018) – held in Rome at CNAIPIC (*Centro nazionale anticrimine informatico per la protezione delle infrastrutture critiche*) facilities. It was organised by the Italian Ministry of Interior with the support of Expert System, PLURIBUS ONE and the University of Cagliari.
- PD3 (26.11.2018) – organized in Rome by the Italian Ministry of Interior with the support of Deep Blue.
- PD4 (22-24.02.2019) – carried out in Belgium for the Cyclocross Oostmalle. The Lokale Politie Voorkempen (LPV) organized it with the support of Crowd Dynamics and the University of Cagliari.
- PD5 (25-27.02.2019) – organized in Germany at the University of Applied Sciences for Public Service in Bavaria by the Fachbereich Polizei (BayHfoeD) with the support of Crowd Dynamics, Expert System, ETRA, University of Cagliari, University of Cantabria and Zenabyte.

The main objectives of these PDs were to:

- Assess the LETSCROWD tools at preliminary stages of the development process;
- Use exercises to test specific components and functionalities of the tools;
- Get feedback from operational experts (LEAs and first responders) in order to refine the tools;
- Test the preliminary integration of the LETSCROWD outcomes into a unique platform: the LETSCROWD server.

General results of the first step of the validation process and the first cycle of PDs can be summarized as follows:

Usefulness: more than 60% of participants considered the LETSCROWD tools tested very useful (Figure 13), 30% rated the tools as neutral and only one participant reported that the tool tested was not useful.

Usability: concerning the System Usability Scale (SUS) scores, most of the LETSCROWD tools were evaluated above the SUS average (i.e. 68, within a 1-100 range). This means that the users' perception of the usability and comprehensibility of the tools was considered good.

Effectiveness: the majority of participants thought that LETSCROWD tools were effective and efficient to complete daily working tasks.

Compatibility: more than 70% of the experts believed that the tools are compatible with the already existing practices and procedures adopted within their organisations and that the tools might be realistically used and integrated within their organisations.

Maturity: the maturity level has been assessed adopting the user perspective. Most of the tools were rated as TRL 4 or 5. This means that participants considered the main components well integrated and ready to be used in simulated operational environments. However, to be reliable, the TRL assessment needs to be integrated with a more technical perspective.

Recommendations from the formative evaluation. At general level, recommendations for the improvement of the LETSCROWD outcomes mainly concern:

- Usability aspects (e.g. simplify the user interface and the information visualization; include new search options);
- Improvement of some technical functionalities (e.g. the tools accuracy in carrying out specific tasks);
- Training LEAs officers to properly use the tools. For some of them, a user manual can be sufficient to facilitate the comprehension of the main functionalities.

Criticalities and lessons learnt. Despite of the quite good results collected in this first validation step, some criticalities arose during the process. It should be noticed that the tools assessed were very different for their technical characteristics, functionalities, purposes and development stages. So, data collected were heterogeneous and not easily comparable. In line with this, the practical demonstrations were organized to test individually the LETSCROWD outcomes through small exercises aimed to assess specific functionalities and components. That is why the number of PDs concerning each tool was different.

6 REFERENCES AND ACRONYMS

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6.2 ACRONYMS

Acronyms List

CNAIPIC	Centro nazionale anticrimine informatico per la protezione delle infrastrutture critiche
DoW	Document of Work
ICF	Informed consent form
PSD	Pre-event Security Decision
RTE	Real Time Evacuation tool
SIE	Semantic Intelligence Engine
HCD	Human Centred Design approach
PDs	Practical Demonstrations
LS	LETSCROWD Server
CMPT	Crowd Modelling and Planning Tool
HCV	Human-Centred computer Vision tool
LEA	Law Enforcement Agency
DRA	Dynamic Risk Assessment
ICP	Innovative Communication Procedures
PMT	Policy making toolkit
FE	Formative Evaluation
SE	Summative Evaluation
SUS	System Usability Scale
TRL	Technology Readiness Level
TFX	Technical and functional exercises

7 ANNEX A – Validation toolkit

The Annex A – Validation toolkit includes:

- Validation instructions
- Validation questionnaire
- Debriefing template
- An example of requirements acceptance scale concerning the Semantic Intelligence Engine

7.1 LEVEL 1 – VALIDATION INSTRUCTIONS

LETSCROWD Validation Toolkit and Instructions

The validation toolkit consists of quantitative and qualitative validation instruments, as follows:

1. Validation questionnaire
2. Debriefing session
3. Requirements acceptance scale
4. Societal impact surveys

Instructions for technology providers on how to use the Validation Toolkit:

1. VALIDATION QUESTIONNAIRE

- The validation questionnaire is composed of four main sections. Each section allows collecting data on one of the identified validation criteria, i.e.: usefulness, usability, compatibility and tools/ software level of maturity. The questionnaire has to be administrated by each technology provider to the LEAs/ first responders involved at the end of the PD.
- Before PD participants start filling out the questionnaires, a related **consent form** (LETSCROWD_ICF_Rev_October18 - https://technologyprojects.etra-id.com/projects/letscrowd/dmsf?folder_id=82) needs to be agreed and signed, to make sure that the data collection is compliant with privacy and ethical issues.
 - Link to the questionnaire – <https://www.surveymonkey.com/r/F2V3LF6>
 - Pdf Version of the questionnaire for printing (use LETSCROWD_01_Validation Questionnaire)

2. DEBRIEFING SESSION

- Once LEAs and/ or first responders who took part at the PD have filled out the questionnaire, the technology provider asks participants to discuss the answers they provided by means of a **debriefing session** (group session). The technology provider will guide the discussion, going throughout all the questions of the questionnaire (use the *D6.3_Debriefing Template.docx*). For each of them s/he will ask participants to motivate and explain their answers, by stimulating and facilitating the debate and the comparison among the different points of view. One or two *note takers* will help the technology provider in charge of the facilitation by writing down all the gathered feedback and comments (i.e. qualitative reporting). A part from the quantitative data collected through the questionnaire, the notes taken during the debriefing session will be analysed as validation results. Thus, it is highly recommended to take clear and detailed notes.
- Use the *Debriefing template* to collect data during the group discussion (LETSCROWD_02_Debriefing Template.docx - https://technologyprojects.etra-id.com/projects/letscrowd/dmsf?folder_id=85).

3. REQUIREMENTS ACCEPTANCE SCALES

A common approach for the requirements assessment could be the following:

3.1 preparing and using a TEST CASE for that tools that can benefit from this strategy (e.g. SIE, HCV, PMT, ...) in order to evaluate the acceptance of requirements that need to be assessed by LEAs. It could be also very useful to differentiate between the requirements that should be assessed by the technology providers and those that require LEAs feedback. This could be done including them under the corresponding "Feature", specifying that they will be evaluated by the technology provider, and including the 'Rationale' field to motivate the answers.

3.2 whatever strategy you'll use to assess the requirements, the collected answers have to be reported in the requirements acceptance scales we will prepare for each tool. This process will facilitate the data analysis.

- Please, remind that all the requirements should be assessed, also those still "immature". In this case, the level of acceptance will be very low at this first assessment stage. You'll explain why in the scales rationale.

The requirements acceptance scales are available at this link:

https://technologyprojects.etra-id.com/projects/letscrowd/dmsf?folder_id=85

4. SOCIETAL IMPACT SURVEYS

Two **online surveys** have been set up to assess the societal impact of the LETSCROWD outcomes (see D6.4). One survey is addressed to citizens; the other one to Law Enforcement Agencies and first responders involved in the project.

All partners of the LETSCROWD consortium should support DBL in recruiting participants and spreading out the survey among their contacts.

DBL will send a dedicated email to start spreading the surveys.

Feedback regarding the societal impact will be collected throughout the duration of the PDs.

- EUROPEAN CITIZENS' ATTITUDE TOWARDS SECURITY IN MASS GATHERINGS EVENTS - <https://www.surveymonkey.com/r/BCXMTSS>
- LAW ENFORCEMENT AGENCIES AND FIRST RESPONDERS' ATTITUDE TOWARDS SECURITY IN MASS GATHERINGS EVENTS - <https://www.surveymonkey.com/r/6GD5MRN>

DATA COLLECTION

At the end of each execution of a PD, each technology provider should send the data collected to DBL as follows:

- The **validation questionnaire** should be administrated using the online version - <https://www.surveymonkey.com/r/F2V3LF6>
Be sure to have a Wi-Fi connection and a digital device (e.g. computer/ tablet, etc.) to fill in the questionnaire. In the case it is not possible to use the online version, you should print the word version (*LETSCROWD_01_Validation Questionnaire*). Once the questionnaire has been filled out, please send it to DBL by email (scanned copy).
- The **requirements acceptance scales** should be filled out by LEAs and/or Technology providers. Technology providers should send to us both the test cases, if you use them (see point 3.1), and the requirements acceptance scales (point 3.2).
- The **debriefing session notes** have to be written down in the *Debriefing Template* (word version) and sent by email.
- The consent form signed, please send it to DBL by email (scanned copy).

@ALL it is recommended to take photo during the execution of the PDs in order to report evidences of the activities in D6.3.

7.2 LEVEL 2 - VALIDATION QUESTIONNAIRE

LETSCROWD - Validation questionnaire
1. Introduction
<p>About the project</p> <p>The following questionnaire is being conducted as part of the LETSCROWD project, funded by the European Commission. The research aims to overcome challenges preventing the effective implementation of the European Security Model with regards to mass gatherings, developing innovative tools and methodologies for security policy practitioners.</p> <p>About your participation</p> <p>The researchers involved in the project will process the data in an anonymous and confidential manner, according to the General Data Protection Regulation (GDPR) (EU) 2016/679:</p> <ol style="list-style-type: none"> 1. The research outputs resulting from this work will only include collected data, without the possibility for anyone to identify your individual answers. Your demographic information will be used only to contextualize the statistical analysis of the aggregate results, and they will not be published or used in any form, rather than the above mention statistical analysis; 2. All the data will be securely stored and used only for the purpose of the present research, in accordance to the ethical requirements; 3. You can withdraw from the questionnaire at any time without any obligation to explain the reasons for doing so. <p>The overall results generated from this exercise may be published in journal articles, conference presentations and via any other mode of scientific exchange and dissemination that will be seen as appropriate by the researchers. However, participants' anonymity will always be protected and all data will be de-identified.</p> <p>If you agree, continue to the next section. For further information about LETSCROWD project please visit our project website at: https://letscrowd.eu/.</p> <p>Thank you for your participation. LETSCROWD consortium</p>

1

LETSCROWD - Validation questionnaire

2. Demographic information

* 1. What is your age?

- ☐ 18 to 24
- ☐ 25 to 34
- ☐ 35 to 44
- ☐ 45 to 54
- ☐ 55 to 64
- ☐ 65 to 74
- ☐ 75 or older

* 2. In what country do you live?

* 3. What is your socio - professional category?

Law enforcement agency
(Please specify your role)

Private security agency
(Please specify your role)

Rescuer (please specify
your role)

Other (please specify your
role)

LETSCROWD - Validation questionnaire

3. General information about the event

* 4. Date

* 5. Place

* 6. LETSCROWD tool assessed

☐ Human - Centred Computer Vision tool (HCV)
 ☐ Policy Making Toolkit (PMT)
 ☐ Semantic Intelligent Engine (SIE)
 ☐ Dynamic Risk Assessment (DRA)
 ☐ Crowd Modelling and Planning tool (CMP)
 ☐ Innovative Communication Procedures (ICP)
 ☐ Real - Time Evacuation tool (RTE)
 ☐ Pre - Event Security Decision Support for LEAs (PSD)
 ☐ LEAs Training PAckage on Human Factors (LTP)

3

LETSCROWD - Validation questionnaire

4. Validation section

* 7. Taking into account the organisation of mass gatherings, how much useful the LETSCROWD tool you tested, is?

- ☐ Very useful
- ☐ Neutral
- ☐ Not very useful

* 8. Which features and components of the tool are the most important to you?

9. Why?

* 10. Which features of the tools are least important to you?

* 11. For each of the following statements^[1], please mark one box that best describes your reactions to the use of the LETSCROWD tool you are testing today.

(One answer per row is allowed)

[1] Statements from a. to l. are part of the System Usability Scale (SUS) (John Brooke, 1986) © Digital Equipment Corporation.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Agree
a. I think that I would like to use this tool frequently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. I found this tool unnecessarily complex	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. I thought this tool was easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. I think that I would need assistance to be able to use this tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. I found the various components in this tool were well integrated	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. I thought there was too much inconsistency in this tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. I would imagine that most people would learn to use this tool very quickly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. I found this tool very cumbersome/awkward to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
i. I felt very confident using this tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
l. I needed to learn a lot of things before I could get going with this tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
m. I can effectively complete my work using this tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
n. I believe that this tool is compatible with procedures already existing in my organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
o. I believe that this tool is realistically applicable in my organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 12. Considering the LETSCROWD tool in its present form, would you say that

- ☐ The basic components of the tool are not yet integrated (TRL 3)
- ☐ The basic components of the tool are integrated to establish that they will work together (TRL 4)
- ☐ The basic components of the tool are integrated with reasonably realistic supporting elements so they can be tested in a simulated operational environment (TRL 5)
- ☐ The tool prototype or model is ready to be tested in a relevant environment (TRL 6)

* 13. Please provide any comments or suggestions concerning the use of the LETSCROWD tool you have tested

* 14. Is there any other specific aspect concerning the evaluation of this LETSCROWD tool that you want us to consider?

7.3 LEVEL 3 – DEBRIEFING TEMPLATE

Date: _____

Place: _____

Tool assessed: _____

Event to which the Practical Demonstration refers: _____

Debriefing session participants:

- Technology provider: _____
- Note takers: _____
- LEAs officers involved (number and roles): _____
- First responders involved (number and roles): _____

Questions	Write down notes concerning the discussion about each question
Taking into account dealing with mass gatherings, how much useful the LETSCROWD tool you assessed, is?	
Which features of the tool are most important to you? Why?	
Which features of the tool are least important to you? Why?	
Would you like to use this tool frequently? (Please, explain your answer)	
Was this tool easy to use? (Please, explain your answer)	
Would you need assistance to use this tool? (Please, explain your answer)	
Did you find the various components in this tool well integrated? (Please, explain your answer)	
Do you think there is too much inconsistency in this tool? (Please, explain your answer)	
Do you imagine that most people would learn to use this tool very quickly? (Please, explain your answer)	
Did you find this tool very cumbersome/awkward to use? (Please, explain your answer)	
Did you feel very confident using this tool? (Please, explain your answer)	
Do you think that you need to learn a lot of things before you can get going with this tool? (Please, explain your answer)	
Can you effectively complete your work using this tool? (Please, explain your answer)	
Do you believe that this tool is compatible with procedures and practices already existing in your organization? (Please, explain your answer)	
Do you believe that this tool is realistically applicable in	

your organization? (Please, explain your answer)	
<p>Which answers did you provide concerning the TRL evaluation? i.e. Do you think that:</p> <p><input type="checkbox"/> The basic components of the tool are not yet integrated (TRL 3)</p> <p><input type="checkbox"/> The basic components of the tool are integrated to establish that they will work together (TRL 4)</p> <p><input type="checkbox"/> The basic components of the tool are integrated with reasonably realistic supporting elements so they can be tested in a simulated operational environment (TRL 5)</p> <p><input type="checkbox"/> The tool prototype or model is ready to be tested in a relevant environment (TRL 6)</p> <p>(Please, explain your answer)</p>	
<p>Please provide any comments or suggestions concerning the use of the LETSCROWD tool you have assessed</p> <p>(Please, explain your answer)</p>	
<p>Is there any other specific aspect concerning the evaluation of this LETSCROWD tool that you want us to consider?</p> <p>(Please, explain your answer)</p>	

7.4 LEVEL 4 - REQUIREMENTS ACCEPTANCE SCALE: THE SEMANTIC INTELLIGENCE ENGINE EXAMPLE

Requirements are qualities, features, capabilities, etc. the specific LETSCROWD tool must have at the end of its development to be useful and usable.

In the LETSCROWD project, a set of requirements has been established for each LETSCROWD outcome (i.e. tool, software and methodology).

We kindly ask you to what extent do you agree or disagree will each of the following statements concerning the requirements of the LETSCROWD outcome you are testing today. One answer per row is allowed.

	Agree	Partially Agree	Disagree	Rationale (Please, explain in detail the rationale behind each of the given answers)
1. The tool allows gathering information from social media platforms, web sites and other web sources according to users' needs and within the boundaries of sources' Terms of Service (SIE_001)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. The tool allows parameterizing the system including the Web Crawler and the Semantic Analysis module (SIE_002)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. The tool may allow filtering geospatially the collected messages according to their	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

associated location whenever it is available or can be inferred (SIE_003)			
4. The tool provides indicators summarizing the semantic analysis (sentiments, and vocabulary) including messages where security measures and vulnerabilities are mentioned discriminating by event phase (SIE_004)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The tool provides a detailed view of the messages including its provenance information and different categories identified by the semantic analysis (SIE_005)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. The tool provides the source of the web content and the “author” as it appears in the web content. The tool considers as “author” the one provided by the source of information (e.g., the author as reported on a web page, a user on a social media platform, etc.) and cannot automatically associate it to a physical person (SIE_006)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. The tool provides a semantic search engine where messages can be found according to their content and categories obtained by the semantic analysis (SIE_007)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. The tool provides functionality to export/save the result of the information gathering and semantic analysis in an information unit called “crowd event object”. Legal compliancy may limit and reduce the amount of information that can be exported/saved. (SIE_008)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. The tool provides a search engine of crowd event objects. A crowd event object holds the result of the information gathering and data analysis for a past event (SIE_009)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. The tool allows browsing the information contained in a crowd event object. A crowd event object holds all the data gathered and analysed for a past event. (SIE_010)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. The tool is in English (SIE_011)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. The tool allows configuring and	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

sending alarms based on the output
of the semantic analysis task.
(SIE_012)

13 The tool provides a suggestion
regarding the possibility that a
message has been written by a
“bot” instead that by a human
being (SIE_013)

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

8 ANNEX B - SUS SCORE INTERPRETATION

With the benefit of 30 years of usage and data from over 10,000 responses and hundreds of products, users can interpret SUS scores in at least five ways as summarized in the figures below.

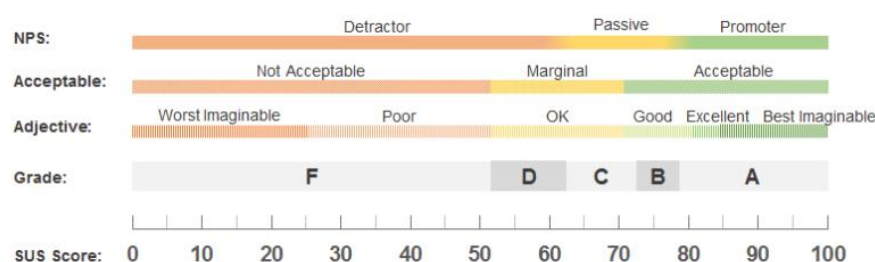


Figure 67: five ways to interpret SUS scores

Grade	SUS	Percentile range	Adjective	Acceptable	NPS
A+	84.1-100	96-100	Best Imaginable	Acceptable	Promoter
A	80.8-84.0	90-95	Excellent	Acceptable	Promoter
A-	78.9-80.9	85-89		Acceptable	Promoter
B+	77.2-78.8	80-84		Acceptable	Promoter
B	74.1 – 77.1	70 – 79		Acceptable	Passive
B-	72.6 – 74.0	65 – 69		Acceptable	Passive
C+	71.1 – 72.5	60 – 64	Good	Acceptable	Passive
C	65.0 – 71.0	41 – 59		Marginal	Passive
C-	62.7 – 64.9	35 – 40		Marginal	Passive
D	51.7 – 62.6	15 – 34	OK	Marginal	Detractor
F	25.1 – 51.6	2– 14	Poor	Not Acceptable	Detractor
F	0-25	0-1.9	Worst Imaginable	Not Acceptable	Detractor

Figure 68: Percentiles, grades, adjectives, and NPS categories to describe raw SUS scores (from <https://measuringu.com/interpret-sus-score/>)

9 ANNEX C – Requirements update

Crowd modelling and planning tool (CMP) and Real-time evacuation tool (RTE) as CMP component - Requirements have not been updated (see D2.1)

Dynamic risk assessment (DRA) - Requirements have not been updated (see D2.1)

Human-centred computer vision tool (HCV) - Requirements have not been updated (see D2.1)

Innovative Communication Procedures – ICP

ID	Description	Update	Update justification
ICP_001	Guidelines shall include an emergency communication framework to support LEAs and other involved stakeholders in developing an effective strategy to communicate with the public.	Not updated	
ICP_002	Guidelines shall support LEAs and other stakeholders in identifying the best communication strategy to ensure public trust the information received and behave properly during the emergency.	Not updated	
ICP_003	Guidelines shall support LEAs and other stakeholders in identifying the best communication strategy to ensure a proper management of the public (avoiding risks), during the emergency.	Not updated	
ICP_004	Guidelines shall support LEAs and other stakeholders in identifying a participative communication strategy to ensure the collaboration of the public in recognizing and managing possible critical situations.	Not updated	
ICP_005	Guidelines shall address the following socio-cultural factors when developing a communication strategy for multiple risk scenarios: Age, Gender, Social Identity, Language, Signs/ Symbols, Individual differences.	Not updated	
ICP_006	Guidelines will be in English and easy to be translated into other languages by their users.	Not updated	
ICP_007	Guidelines shall include a multi-channel approach to effectively communicate with a multicultural crowd.	Not updated	
ICP_008	Guidelines shall include the state of the art in emergency communication with multicultural crowd.	Not updated	
ICP_009	Guidelines shall clearly identify other stakeholders that could be involved and their roles in the communication strategy.	Not updated	
ICP_010	Guidelines shall include illustrative cases to facilitate the application of	Guidelines shall include an illustrative	A more generic - but operative

	the communication strategy set up.,	workflow to facilitate the application of the communication strategy to an event	approach – has been considered as more useful to cover a broader category of events. In the ICP, illustrative cases have been replaced with a typical workflow that shows an example of the application of the ICP components to a generic event for the setup of the communication strategy.
ICP_011	Guidelines should be compatible with the communication procedures already applied by the stakeholders in charge of communication in a mass gathering.	New requirement	The new requirement underlines how much is relevant that ICP are compatible with the communication strategies already in place within organizations.

Policy Making Toolkit (PMT) and the Pre-event security decision tool (PSD) as component of the PMT

ID	Description	Update	Update justification
PMT_001	The tool will help authorities to make a decision to approve or not a planned crowded event, based on a database with data of past events and rules and measures based on the data of the current event.	Not updated	
PMT_002	The tool will use the data introduced to grow the database and make it smarter than before with every use.	Not updated	
PMT_003	The tool will contain an initial database of the most important and different events before releasing the tool.	Not updated	
PMT_004	The tool should be as friendly and fast as possible with auto completion features, keyboard shortcuts and helpers.	Not updated	
PMT_005	The tool should to not make the user wait for loading processes when filling the form.	Not updated	
PMT_006	The tool will be at least in English.	Not updated	
PMT_007	The tool will have different user roles (Event planner has different access type than LEA or person that authorizes event).	Not updated	
PMT_008	The tool will consider 8 different statuses for an event.	The tool considers 6 different statuses	There are five states: pending,

		for an event.	approved, active, closed, cancelled.
PMT_009	The tool will allow registering and handling users with different roles.	Not updated	
PMT_010	The tool will be able to communicate with the other applications and integrate useful data from them.	Not updated	
PMT_011	The tool must be able to include other languages easily.	Not updated	
PMT_012	The tool should allow to create more roles as needed.	Not updated	
PMT_013	The tool should allow to create more event states as needed.	Not updated	
PMT_014	The tool will include a list of predefined values for each aspect related to event.	Not updated	
PMT_015	The tool will allow the authority to create a report after authorising or denying and after closing an event.	Not updated	
PMT_016	The tool should contain and initial database of security policies, best practices and guidelines related to mass gatherings.	Not updated	
PMT_017	The tool should have an initial database of relevant information, including that one regarding citizen's reactions and perceptions, useful to the policy making process.	The policies are inserted and customized by the admin but there is not any initial database.	There is no initial database because for each event a database can be implemented (open events, closed events, fireworks event etc). It will be providing an example of an event with their related database as an example that it could be implement an initial database for each event.
PMT_018	The tool will be able to be easily updated with new inputs.	Not updated	
PMT_019	The tool should be able to support policy makers regarding different types of policies, for different levels of planning, control and management and diverse sort of events.	The laws of each policy to be met are grouped into conditional and mandatory. For an event to have an approved policy is. It is necessary that all conditional and mandatory laws, respectively, be complied with. If one of them is not met, the event will not comply with the policy. The application must recalculate policies before the	Better requirement description

		dynamic change of any of its mandatory or conditions.	
PMT_020	The tool will allow reference for all LEA's and authorities across the EU.	Not updated	
PMT_021	The tool will have a search feature for the database.	Not updated	
PMT_022	The tool should allow to create reports of any kind to ensure EU standardization.	Not updated	
PMT_023	The tool will have a section to just add data to the database.	Not updated	
PMT_024	The tool should index added information to the database.	Not updated	
PMT_025	The tool may show relevant and related data when entering data.	Not updated	
PMT_026	The data analytics tool will process data stored in a database structured according to a precise data model.	Not updated	
PMT_027	The data analytics tool will provide search and visualization functionalities to each category of users of the PMT.	Not updated	
PMT_028	The access to the data of the PMT database through the data analytics tool will be limited according to the role of each category of users.	Not updated	
PMT_029	Data will check consistency when added.	Data consistency is checked in the database when they are added.	Better requirement description.

ID	Description	Update	Update justification
PMT_030 (PSD)	The PSD tool will help LEAs to know the level of security hazard of the mass gathering during the event preparation.	New Requirement	This new requirement allows the PSD tool to generate a number between 0 and 1 and the associated rating scale of the security hazard for a given mass gathering event (0-0.25 Low; 0.25-0.5 medium; 0.5-0.75 high; 0.75-1 extreme). That way, the user has a preliminary assessment for security planning (e.g. resources allocation, security measures and precautions to put in place).

PMT_031 (PSD)	The PSD tool will allow the user to introduce inputs related to the event, the venue, the crowd and intelligence.	New Requirement	Several aspects should be taken into account when assessing security planning of a mass gathering event. This new requirement allows the characterization of the mass gathering through the PSD based on: event (type, conflict/history, duration), venue (type, space for crowd, assets to protect), crowd (number of people, age composition, purpose, expected crowd behaviour, level of membership participation and identification) and intelligence (expected infringements, terrorist alert level).
PMT_032 (PSD)	The PSD tool will provide as outputs the indicator of security hazard (numerical value between 0 and 1 and a rating scale), the suggested security protocols and a summary report.	New Requirement	The PSD tool not only provides the security hazard indicator, but it also suggests the security protocols accordingly. Note that these protocols can be suited to each LEA needs and criteria. The PSD tool also generates a summary report giving account of inputs and outputs of a specific event that has been analysed.
PMT_033 (PSD)	The PSD tool should allow the possibility to save/open created event files.	New Requirement	This new requirement allows the user(s) to open files of events previously analysed to easily and quick update/modify them. This is useful as security planning is a continuous process. This enables sharing the files between different users as well.

Semantic Intelligence Engine (SIE)

ID	Description	Update	Update justification
SIE_001	The tool will allow crawling social media and other web sites that will be defined according to user needs.	The tool will allow the gathering of information from social media	To the initial version of this requirement, the need to abide by the

		platforms, web sites and other web sources according to users' needs and within the boundaries of sources' Terms of Service.	terms of service of each platform from which data are collected have been added.
SIE_002	The tool will allow parameterizing the system including the crawler and the semantic analysis module.	The tool will allow parameterizing the system including the Web Crawler and the Semantic Analysis module.	Syntactic Rewriting: use the more specific term Web crawler instead of crawler.
SIE_003	The tool may allow filtering geospatially the crawling of messages according to the coordinates of the post whenever the source offers this functionality.	The tool may allow filtering geospatially of the collected messages according to their associated location whenever it is available or can be inferred.	Geographical coordinates are replaced by location, which is more generic.
SIE_004	The tool will provide indicators summarizing the semantic analysis (sentiments and vocabulary) including messages where security measures and vulnerabilities are mentioned discriminating by event phase.	The tool will provide indicators summarizing the semantic analysis (sentiments and vocabulary) including messages where security measures are mentioned, by discriminating the event phase.	Vulnerabilities are identified by LEAS. It is unlikely that vulnerabilities can be found in user-generated content that is the main source of data for the text analysis engine.
SIE_005	The tool will provide a detailed view of the messages including its provenance information and different categories identified by the semantic analysis.	Not updated	
SIE_006	The tool will provide a detailed view of the authors of messages in the event and the messages itself.	The tool will provide the source of the web content and the "author" as it appears in the web content. The tool considers as "author" the one provided by the source of information (e.g., the author as reported on a web page, a user on a social media platform, etc.) and cannot automatically associate it to a physical person.	The reference to a detailed view of authors has changed into the source of information and the author information as provided by the web content within the boundaries of the privacy (GDPR) and legal compliance (Terms of Use).
SIE_007	The tool will provide a semantic search engine where messages can be found according to their content and categories obtained by the semantic analysis.	Not updated	

SIE_008	The tool must provide a functionality to export/save all the documents crawled and their semantic analysis in an information unit called crowd event object.	The tool must provide a functionality to export/save the result of the information gathering and semantic analysis in an information unit called "crowd event object". Legal compliancy may limit and reduce the amount of information that can be exported/saved.	Limitations due to the legal compliance have been introduced.
SIE_009	The tool must provide a search engine of crowd event objects. A crowd event object holds all the data crawled and analysed for a past event.	The tool must provide a search engine of crowd event objects. A crowd event object holds the result of the information gathering and data analysis for a past event.	Syntactic Rewriting: use the verb "gather" instead of "crawl".
SIE_010	The tool must allow browsing the information contained in a crowd event object. A crowd event object holds all the data crawled and analysed for a past event.	The tool must allow browsing the information contained in a crowd event object. A crowd event object holds all the data gathered and analysed for a past event.	Syntactic Rewriting: use the verb "gather" instead of "crawl".
SIE_011	The tool will be first in English, and then translated into other languages after its reliable.	Not updated	
SIE_012	The tool must allow configuring and sending alarms based on the output of the semantic analysis task.	Not updated	
SIE_013	The tool may allow distinguishing when messages are written by humans or bots.	The tool may provide a suggestion regarding the possibility that a message has been written by a "bot" instead that by a human being.	More specific requirement making emphasis on the probability of something being written automatically by a bot or by a human user.

10 ANNEX D – Test cases

The Annex D includes the test cases used as exercises during the evaluation of some of LETSCROWD tools, i.e.:

- HCV test case – PD1: <https://seafire.dblue.it/f/63de547a1f494ad798a2/>
- HCV test case – PD4: <https://seafire.dblue.it/f/72ce9aecd7d14b518f4c/>
- HCV test case – PD5: <https://seafire.dblue.it/f/9758333ed2e049d9b105/>

LETSCROWD tool	Human-centred computer vision (HCV) tool
Event	Practical demonstration with volunteers at the University of Applied Sciences for public Service in Bavaria – Department of Policing (Fürstenfeldbruck, Germany, Feb. 25-27, 2019)
Description	The HCV tool is used by LEA operators to support them in two tasks: (i) crowd monitoring during event execution, to estimate the density of the crowd from videos; (ii) analyzing recorded videos in a post-event forensic investigation involving the search for a specific individual of interest, either seen by an operator in one video (image-based person re-identification), or described by an eyewitness, including LEA operators in the field (attribute-based people search)
Scope	The HCV tool will process videos acquired by a video cameras installed ad hoc for this PD by UNICA and other technology providers

User story		Requirements validation	
Sequence of tasks	Feature	Requirement ID and priority, and acceptance criteria	Acceptance criteria fulfilled? (LEA or tech. prov. input)
1) The technology provider trains the involved LEA operators to use the HCV tool on publicly available videos collected by the computer vision research community	LEA operators training	HCV_002 (5): the HCV tool is compliant with related regulations, and is compatible with LEA's internal procedures	LEA: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: The HCV tool provides features that would be added to CCTV systems already used by Bavarian Police to monitor mass gathering events. Estimating the number of people in a crowd is compatible with existing procedures and practices. Searching for suspect individuals is also compatible, but existing regulations restrict it only to forensic investigations (ex post analyses) for crime

			prosecution/investigation
		HCV_003 (5): Publicly available data sets have been used for the development of the HCV tool, and are made available to LEAs for tool validation	Tech. prov.: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: Publicly available data sets (among the ones mentioned in deliverable D5.4) have been used to design the HCV tool. Two of them were available to train LEA officers involved in the practical demonstration, but have not been used, since videos acquired in this PD could be used also to show LEA officers the working of the HCV tool
		HCV_006 (3): LEA operators are able to understand and use the HCV tool with minimal training	LEA: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: There has been not enough time to let the involved LEA officers to use the tool, but they found it easy to understand, and felt it would be easy to use with a minimal training
		HCV_009 (5): The HCV tool is in English	LEA: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: The whole user interface is in English
		HCV_014 (3): During the HCV tool design phase videos acquired by video surveillance systems during relevant, real or simulated mass gathering events have been provided by LEAs or other project partners	Tech. prov.: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: Simulated videos have been provided by Crowd Dynamics during the development phase of the crowd density estimation functionality, to complement the publicly available (scarce)

			annotated videos for training the underlying machine learning algorithms. All the videos acquired during this PD are available to UNICA for improving the HCV tool, only for the purposes of this project
		HCV_015 (4): LEAs can access and validate the HCV tool through a web-based interface	LEA: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: The tool is accessible through a web-based interface (i.e., through a web browser).

User story		Requirements validation	
Sequence of tasks	Feature	Requirement ID and priority, and acceptance criteria	Acceptance criteria fulfilled? (LEA or tech. prov. input)
1) LEA personnel and the technology provider install the available video cameras and set the camera views to test the crowd density estimation functionality (the only one currently implemented in the crowd monitoring tool), taking into account HCV tool's specifications (see next column) 2) The technology provider and the LEA define the movements and actions to be performed by the volunteers recruited by the LEA, who will simulate different behaviours of a crowd 3) Videos recorded from the selected camera views are loaded by LEA operators into the HCV tool 4) Selected videos are watched by LEA operators on the HCV tool user interface, together with the estimated crowd density, simulating a real time monitoring scenario	Configuration and test of the crowd monitoring tool (crowd density estimation functionality)	HCV_007 (5): The crowd monitoring tool provides the required functionality on videos acquired by standard, fixed or PTZ, video surveillance colour cameras, with tilt angle with horizontal plane of about 45 degrees or more, and height of about 5 m or more.	Tech. prov.: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: The crowd density estimation functionality was tested on videos acquired during this PD from a fixed colour camera provided by UNICA, placed at about 5 m height, with a tilt angle with the horizontal plane of about -45 degrees
		HCV_010 (5): The HCV tool provides in a distinct software tool a crowd monitoring functionality, including anomaly detection in crowd behaviour, crowd density estimation and group detection, and is perceived to be useful in terms of efficiency and efficacy during LEA operators' duties	Tech. prov. (available functionalities): <input type="checkbox"/> Agree <input checked="" type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: Only the crowd monitoring functionality is currently implemented; the other ones are under implementation LEA (perceived efficiency and efficacy):

			<input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input checked="" type="checkbox"/> Disagree Rationale: It is not possible to answer this question, since the officers who validated the tool are members of a Police Officers School and are not directly involved in CCTV-related monitoring tasks during mass gathering events. What can be said is that this tool looks as a valuable add-on for officers and operators directly involved in those tasks, provided that issues related to its accuracy can be addressed (see the debriefing questionnaire for more details)
		HCV_016 (1): if the applicable regulations allow the use of videos acquired by RPAs for crowd monitoring in mass gathering events of interest to LETSCROWD, and this kind of video is available for this PD, the crowd density estimation tool is capable to analyse it	Tech. prov.: <input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input checked="" type="checkbox"/> Disagree Rationale: No RPAs were used to acquire videos during this PD

User story		Requirements validation	
Sequence of tasks	Feature	Requirement ID and priority, and acceptance criteria	Acceptance criteria fulfilled? (LEA or tech. prov. input)
1) LEA personnel and the technology provider install the available video cameras and set the camera views to test the image-based person re-identification tool, taking into account HCV tool's specifications (see next column) 2) The technology provider and the LEA define the movements and actions to be performed by the volunteers recruited by the LEA; some of the volunteers will play the role of the "individuals of interest" to be searched in the videos, while other volunteers will play the role of generic individuals appearing in the same videos 3) Videos recorded from the selected	Configuration and test of the image-based person re-identification tool	HCV_005 (5): The tool allows LEA operators to provide specific feedback on its output; feedback information is used to improve the tool's effectiveness during time, including immediate re-processing of a query in the person re-identification functionality	Tech. prov.: <input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input checked="" type="checkbox"/> Disagree Rationale: This functionality is currently under implementation and is not available yet
		HCV_008 (3): The image collecting and processing where only affects the external aspect of people will have to exclude discriminatory criteria that are not criminological based. The discriminatory	Tech. prov.: <input checked="" type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree Rationale: The HCV tool collects the images of all the

<p>camera views are loaded by LEA operators into the HCV tool</p> <p>4) Selected videos are watched by LEA operators on the HCV tool user interface, simulating a forensic investigation scenario. To test the tool, LEA operators stop one of the videos where one of the volunteers appears (simulating an "individual of interest"), select its image by a drag and drop operation, and ask the tool to retrieve from <i>all</i> the previously selected videos images of individuals exhibiting a similar clothing appearance; then they scroll the list of retrieved images, check whether the same volunteer appears near the top of the list, and select some of the retrieved images to access context information. As an additional step required for the evaluation of the tool, LEA operators also check if the top-ranked images retrieved by the system actually contain individuals exhibiting a similar clothing appearance to the query individual. The above steps should be repeated several times to search for images of different volunteers, or of the same volunteer but starting from different images</p>		<p>selection must be reasoned or justified/cleared by LEPMI</p>	<p>individuals detected in the processed videos, and matches them with an image selected by a LEA operator, only on the basis of low-level image features (e.g., colour histograms and texture). No high-level matching criteria susceptible to of being discriminatory are used</p>
		<p>HCV_011 (3): The HCV tool provides a person re-identification functionality available in a distinct software tool, which is found to be useful in terms of efficiency and efficacy during LEA operators' duties</p>	<p>LEA:</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>Rationale: It is not possible to answer this question, since the officers who validated the tool are members of a Police Officers School and are not directly involved in CCTV-related monitoring tasks during mass gathering events.</p> <p>What can be said is that this tool looks as a valuable add-on for officers and operators directly involved in those tasks, although its effectiveness (accuracy) can be low in mass gathering events where many people are likely to wear similar clothing (e.g., supporters of popular football teams)</p>
		<p>HCV_013 (5): The person re-identification tool provides the required functionality on videos acquired by standard, fixed/PTZ/mobile (managed by stewards/agents), video surveillance colour cameras, with tilt angle with horizontal plane less than -45 degrees, and height of about 3 m or less</p>	<p>Tech. prov.:</p> <p><input type="checkbox"/> Agree</p> <p><input checked="" type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p> <p>Rationale: This functionality was tested on videos acquired during this PD from (four) fixed colour cameras, placed at about 1.5 to 3 m height, with tilt angle lower than -45 degrees with the horizontal plane</p>

User story		Requirements validation	
Sequence of tasks	Feature	Requirement ID and priority,	Acceptance criteria fulfilled?

		and acceptance criteria	(LEA or tech. prov. input)
<p>1) LEA personnel and the technology provider install the available video cameras and set the camera views to test the attribute-based people search tool. The selection should take into account HCV tool's specifications (see next column)</p> <p>2) The technology provider and the LEA define the movements and actions to be performed by the volunteers recruited by the LEA (this task is shared with task 2 of the image-based person re-identification tool)</p> <p>3) Videos recorded from the selected camera views are loaded by LEA operators into the HCV tool</p> <p>4) To test the tool simulating a forensic investigation scenario, a description of the appearance of one of the volunteers playing the role of an "individual of interest" is selected by the LEA operators using the GUI of the HCV tool, in terms of a set of predefined attributes (clothing colour, gender etc.). Then they ask the tool to retrieve from <i>all</i> the previously selected videos images of individuals exhibiting a similar attribute profile, and scroll the list of retrieved images, checking whether the same volunteer appears near the top of the list. They also select some of the retrieved images to access context information. As an additional step required for the evaluation of the tool, LEA operators also check if the top-ranked images retrieved by the system actually contain individuals exhibiting an attribute profile similar to the selected one. The above steps should be repeated several times using different attribute profiles corresponding to the involved volunteers</p>	<p>Configuration and test of the attribute-based people search tool</p>	<p>HCV_012 (3): The HCV tool provides a people search functionality available in a distinct software tool, which is found to be useful in terms of efficiency and efficacy during LEA operators' duties</p>	<p>LEA:</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>Rationale: It is not possible to answer this question, since the officers who validated the tool are members of a Police Officers School and are not directly involved in CCTV-related monitoring tasks during mass gathering events.</p> <p>What can be said is that this tool looks as a valuable add-on for officers and operators directly involved in those tasks, although its effectiveness (accuracy) can be low in mass gathering events where many people are likely to wear similar clothing (e.g., supporters of popular football teams)</p>
		<p>HCV_013 (5): The people search tool provides the required functionality on videos acquired by standard, fixed/PTZ/mobile (managed by stewards/agents), video surveillance colour cameras, with tilt angle with horizontal plane less than -45 degrees, and height of about 3 m or less</p>	<p>Tech. prov.:</p> <p><input type="checkbox"/> Agree</p> <p><input checked="" type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p> <p>Rationale: This functionality was tested on videos acquired during this PD from (four) fixed colour cameras, placed at about 1.5 to 3 m height, with tilt angle lower than -45 degrees with the horizontal plane</p>
		<p>HCV_005 (5): The tool allows LEA operators to provide specific feedback on its output; feedback information is used to improve the tool's effectiveness during time, including immediate re-processing of a query in the people search functionality</p>	<p>Tech. prov.:</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>Rationale: This functionality is currently under implementation and is not available yet</p>

- SIE test case – PD1: <https://seafire.dblue.it/f/bc9f420b1267447f8d9b/>

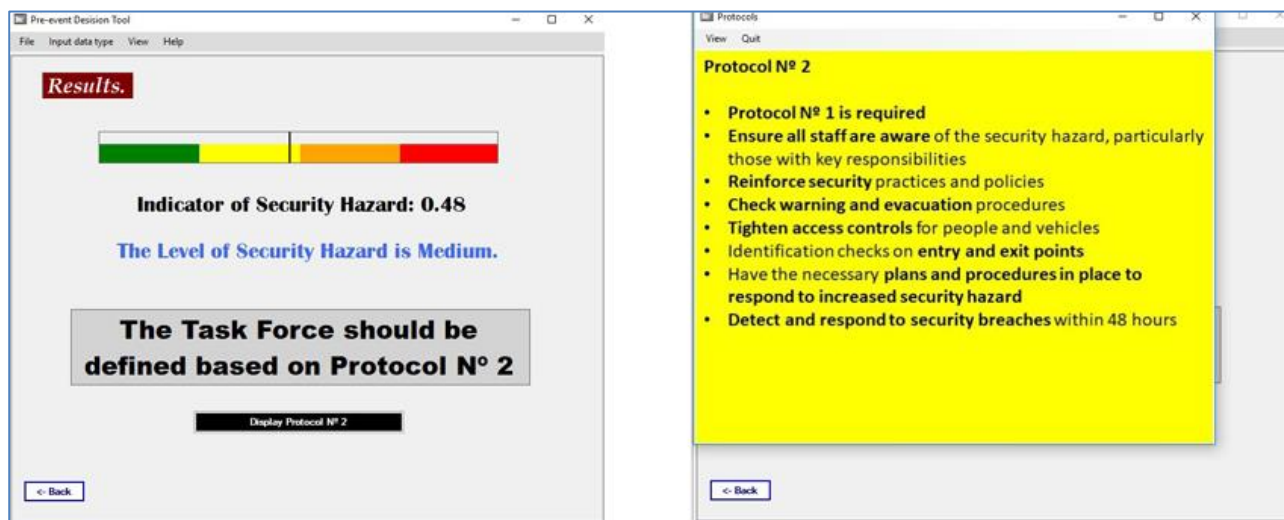
Test Case	Web Monitoring	Execution Date	03/11/2018
Letscrowd Tool	Text Analysis Engine		
Event	MTV EMA 2018 in Bilbao		
Description	The text analysis engine is used to monitor the web content that is appearing in the preparatory stage of the event MTV EMA 2018 hosted by Ertzaintza in Bilbao.		
Scope	Languages covered are English, Spanish, Basque. Do not include social media channels.		
User story		Requirements Validation	
Sequence of tasks	Feature	Requirement (ID-Priority: Acceptance Criteria)	Acceptance Criteria Fulfilled?
Actor 1: Security Analyst (LEA) 1- Provides the following data to setup the web crawler regarding the web pages to be monitored: <ul style="list-style-type: none"> - a list of keywords (words, hashtags, user mentions) that needs to appear in the web pages - Language(s) - Region: Country of publication, or all - Source Type: News, Blogs, Web, Discussions (Forums, and Q&A), Videos (only text metadata is processed) - Dates: Initial and End dates for the monitoring 	Web Crawler: Configuration	SIE_002-5: The security analyst is able to select the source type, define the time interval of the crawling and the keywords	SIE_002-5: (LEA input) <input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree
Actor 2: Support (Technology Provider) 2- Configures the web crawler to spot and retrieve new web pages according to the analyst input 3- Run the web crawler to gather new web content according to the analyst requirement		SIE_003-1: The crawling of messages could be restricted to messages posted in a certain geographic area.	SIE_003-1: (LEA input) <input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree
Actor 1: Security Analyst (LEA) 4- Use the dashboard to visualize the web pages gathered by the Web Crawler (see the user manual for instructions in how to go and use the dashboard): <ul style="list-style-type: none"> - Check "total hits" in the first column for the number of documents gathered - Check the "time series" histogram in the first column to see the number of documents gathered by the Web Crawler per unit of time. You can hover the mouse over each bar to see the number of documents. - Browse to the bottom end of the dashboard to the table entitled "Web Content" and check some of the web pages gathered by the Web Crawler. 	Web Crawler: Execution	SIE_001-5: Documents extracted from the source types defined in configuration	SIE_001-5: (LEA input) <input type="checkbox"/> Agree <input type="checkbox"/> Partially Agree <input type="checkbox"/> Disagree
Actor 2: Support (Technology Provider) 5- If no documents are shown it could be due to a bad usage of the dashboard. The support user will check			

the dashboard configuration and usage to fix the issue.			
<p>Actor 1: Security Analyst (LEA)</p> <p>5- In the dashboard review the semantic analysis indicators. Go through each of the following indicators:</p> <p>Second Column Indicators:</p> <ul style="list-style-type: none"> - Geo-localization panel: Map indicating the countries which are mentioned in the web content. - Data sources panel: Table showing the distribution of web pages gathered per source - Organization, People and Places Panels: Tables showing the distribution of names of organizations, people and places mentioned in the web pages <p>Third column indicators:</p> <ul style="list-style-type: none"> - Language panel: Pie showing the distribution of web pages gathered by language - Frequent Terms panel: Tag cloud with the most frequent words - Emotions Panel: Histogram of emotions per document - Criminal, Cyber-Illegal, and Military Slang register Panels: Line charts showing the number of documents according to slang use scale. 	SIE: Dashboard	<p>SIE_004-4: An overview summarizing the semantic analysis indicators is available</p> <p>SIE_011-5: The tool supports English.</p>	<p>SIE_004-4: (LEA input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p> <p>SIE_011-5: (LEA input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p>
<p>Actor 1: Security Analyst (LEA)</p> <p>6- Pose a query by specifying search criteria in the first column panel:</p> <ul style="list-style-type: none"> - Use keywords in the query panel. For example, query by "Piztu Bilbo" - See how all the panels in the dashboard change synchronously and according to the subset of documents that match the query. - Change the time filter. For example, use the relative picker and set 30 days before today. - Use the taxonomies in the facets to filter documents according to the categories of interests. <p>Visualize the filters currently applied in the dashboard and remove the last one to undo the last filter added.</p>	SIE: Search Engine	SIE007-6: A search engine is available	<p>SIE_007-6: (LEA input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p>
<p>Actor 1: Security Analyst (LEA)</p> <p>7-scroll down to bottom end table "Web Content" Visualize in detail the documents plus the metadata that the semantic intelligence engine has added.</p> <ul style="list-style-type: none"> - Click on any row and visualize all the semantic metadata added by the text analysis engine. To do so change, at the row level, the view mode to json and pay attention to the metadata, including: emotions_categories, people, organizations, places, register_slang, etc. - Use the magnifier glass under the link column to 	SIE: Dashboard	SIE005-5: A view with detailed information of a message, its provenance and semantic analysis is available	<p>SIE_005: (LEA input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input type="checkbox"/> Disagree</p>

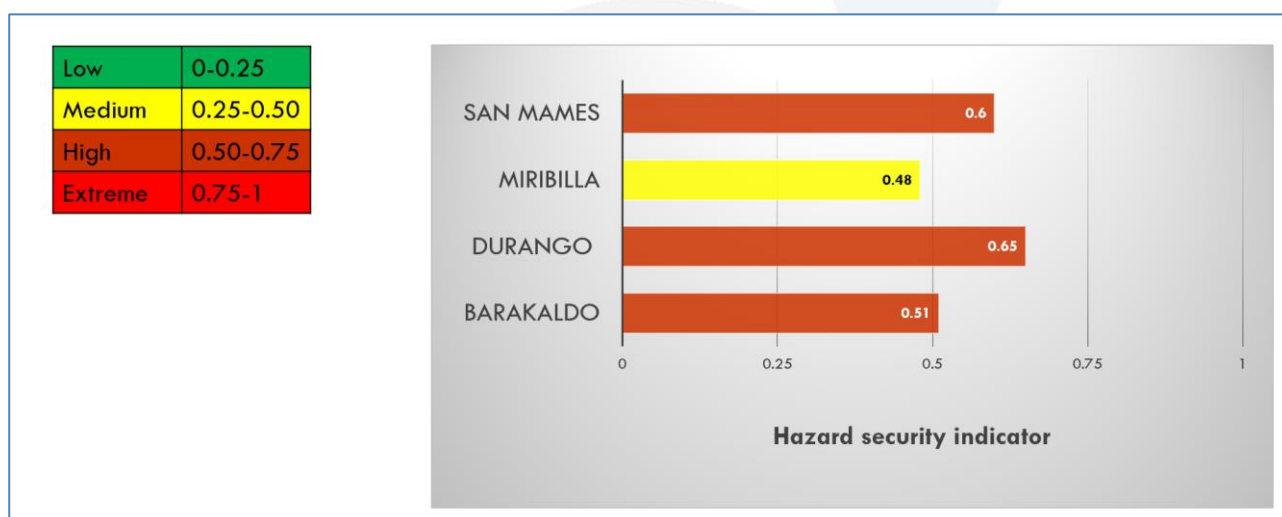
browse the source web page.			
REQUIREMENTS NOT COVERED IN THIS PRACTICAL DEMONSTRATION			
	SIE: Dashboard	<p>SIE006-5: A view with detailed information of the authors is available</p> <p>SIE013-1: A tool to detect if the message was written by bots or humans</p>	<p>SIE_006: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>SIE_013: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p>
	SIE: Crowd Event Object	<p>SIE008-3: Export functionality available</p> <p>SIE009-3: Crowd Event Object search engine available</p> <p>SIE010-3: A view of crowd event objects content is available</p> <p>SIE012-3: An alarm configuration tool is in place</p>	<p>SIE_008: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>SIE_009: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>SIE_010: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p> <p>SIE_012: (Tech Provider input)</p> <p><input type="checkbox"/> Agree</p> <p><input type="checkbox"/> Partially Agree</p> <p><input checked="" type="checkbox"/> Disagree</p>

- SIE test case – PD2: <https://seafire.dblue.it/f/8355fc4c8b12442bb6c8/>
- SIE test case –PD5: <https://seafire.dblue.it/f/cd5ac23952f8425592a8/>

11 ANNEX E – Example of PPT produced using PSD tool



PSD results produced for the MTV concert in Bilbao-Miribilla 31st October 2018



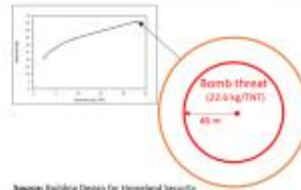
PSD Hazard Security Indicators produced for the MTV concerts analysed

12 ANNEX F – Example of PPT produced during pre-event analysis of Barakaldo concert using RTE tool

Barakaldo-Concert 29 October, 2018

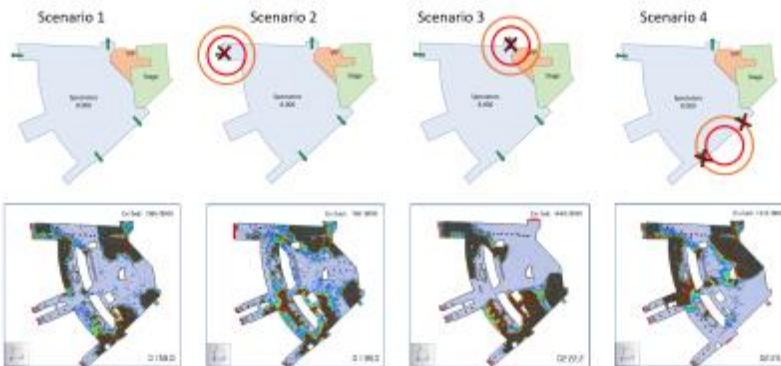


- 8.000 occupants
- 250 runs/scenario
- Occupants initially located in the perimeter
- The distribution of occupants per exits is proportional to the available exits
- The emergency is a bomb threat (suitcase 22,4 kg/TNT) minimum standoff evacuation distance of 46 m.



Source: Building Design for Homeland Security
Lecture 8 - Explosive Blast
https://www.fema.gov/566330/secure/256_m7_ppt6.htm

Evacuation results (Pathfinder)



Evacuation results (RTE tool)

