pulse

Platform for European Medical Support During Major Emergencies

D9.3 Exploitation Plan

PULSE

Platform for European Medical Support during major emergencies

WP9_Exploitation & dissemination

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VIOREL PETCU	ONEST SOLUTIONS	WP# (1-9)

Authors (organisation)
Viorel Petcu (ONEST SOLUTIONS – ONEST)
Rowena Rodriguez (TRILATERAL - TRI)
Sarah Bourke (SKYTEK - SKY)
Paul Kiernan (SKYTEK - SKY)
Paolo Pucci (FINMECCANICA/LEONARDO - FINM)
Reinhard Hutter (CESS)
Cian OBrian (HSE)
Sabina Magalini (UCSC)

Abstract:
This document contains the PULSE's Exploitation plan, which describes the exploitation of the PULSE results with an emphasis on how the results will impact society as a whole and the EU CI security.

Keywords:
Major medical emergency, health services, preparedness, response, crisis management, standardized procedures and processes, SARS, weak, signal detection, threat analysis

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1   Introduction

1.1 Purpose and scope of the Document

The plan definition is a continuous process, based on a number of internal and external factors. These factors are related not only with the specific technological results achieved in each of the solutions the PULSE partners have worked on, but also other organizational, legal, social and market related issues.

The main objectives of the plan are to identify and describe the opportunities to commercialize and exploit the project results and to do a review of market and technological trends, in order to identify potential competitors. This approach is compliant with the Consortium Agreement and it provides guidelines to partners for the preparation of business plans.

This document makes a description of key exploitable results from the project, clearly identifying those that have the best opportunity to become successful commercial products. This deliverable also provides a market analysis in order to support project partners to find appropriate exploitation channels and to co-ordinate the optimal exploitation of the PULSE results. The PULSE's technological partners will provide an integrated vision of all the activities and results of the work packages in PULSE, as well as guidelines and advice about new opportunities. This approach will also allow the team members to identify target groups, markets and domains towards addressing requirements of users, service providers, public bodies, etc.

1.2 Structure of the Document

The document is structured in five sections:
- Section 1 explains the rationale and the purpose of the document.
- Section 2 summarizes the general objectives and outcomes of PULSE to draw the context of the exploitation strategy, identifying for each result or service the market definition, market trends and the potential customers.
- Section 3 provides the PULSE Exploitation Plan, starting with the identification and description of the exploitable results to set the scene for the standalone exploitation strategy of each partner.
- Section 4 will focus on the description of the Consortium Level Exploitation Plan.
- Section 5 is the Conclusions section.

2   PULSE Overview

PULSE project concept was developed taking into consideration the actual European context and the necessity of European Health Services (EHS) to be prepared and to respond efficiently to the pandemic diseases or other major incidents with a large number of casualties.

European Health Services is one of the core emergency response services to major threats (pandemic disease, major terrorism attacks). EHS includes hospitals, community health services, pre-hospital emergency care services, medical suppliers, rescue services, health related voluntary services and others. EHS has an important role in both preparedness and response phase, so it is necessary to maintain and improve its activity through effective planning, decision support tools and advanced methods and tools providing support in the response phase (e.g. common operational picture, creation of surge capacity, medical records history of the patients etc.). An interoperable framework is also needed in order to be able to provide a coordinated European response to any major medical incident.

The project began by studying the procedures, processes and training requirements in current operation at EHS with the support of potential end users of the project.

2.1   PULSE Objectives

PULSE main objectives:

OBJ1.   To develop a standardised approach to improve preparedness, response and decision making across Europe for specific major medical emergencies.

OBJ2.   To provide an EU wide operational and technical framework to enable risk managers to undertake a threat analysis situation assessment and forecast and to react accordingly with effective decision making, resources and logistics planning, assignment and control.

OBJ3.   To develop innovative technology and tools to support preparedness, response and decision making and present a common operational picture to emergency personnel.

OBJ4.   To identify how improved legislation, directives and guidelines across Europe could enable a better decision making, preparedness and cooperation, taking into consideration the protection of human rights and social norms.

OBJ5.   To develop an open operational and technical platform which will define, develop and validate procedures and processes, develop architecture and a set of technologies and tools to improve –by

design– the preparedness, reliability and preparedness of European states to manage a medical crisis.

OBJ6.   To develop a draft suite of European standard for large scale medical emergency including 'common vocabulary and definitions' – suitable for Europe and an integral part of our dissemination strategy.

OBJ7.   To promote PULSE and the project results – timely and efficiently disseminate the project results; implement feasibility study and environmental analysis for effective exploitation of the project results.

2.2 PULSE Architecture

PULSE system architecture it is summarized into the next picture:
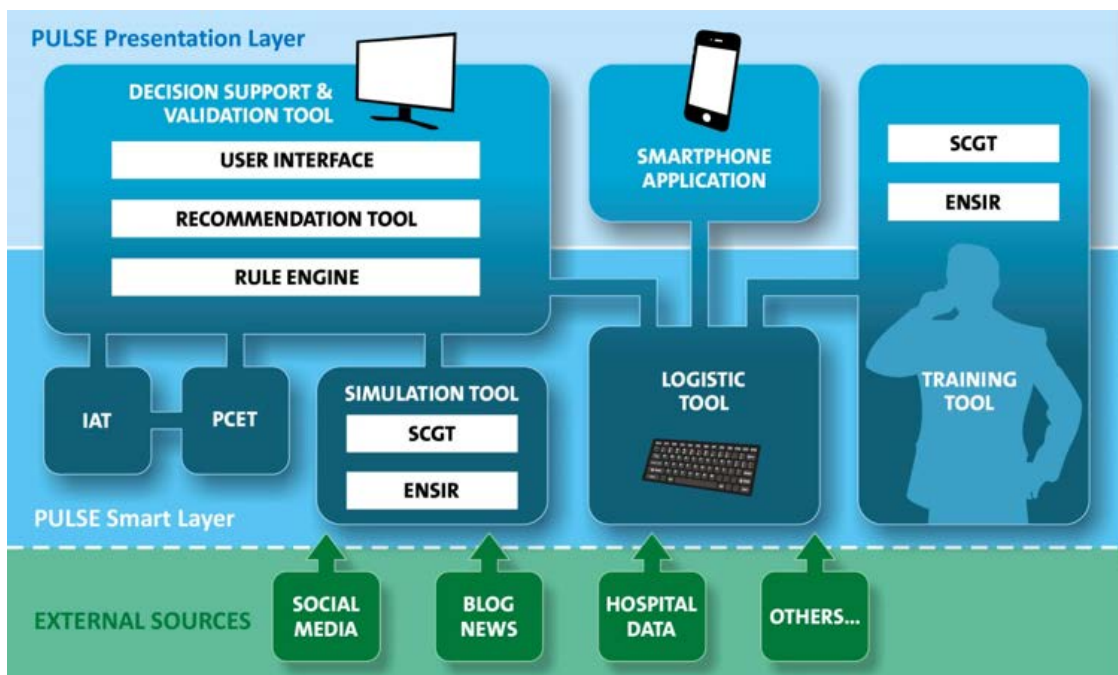
Figure 1 PULSE Architecture

2.3 PULSE Outputs

The overall objective of PULSE is to improve the preparedness and response of Health Services involved in emergency situations to mitigate the loss of life and improve survival rates among mass casualties. The expected impacts of the PULSE project are:

- Improved preparedness of Health Services
- Improved response of Health Services
- A comprehensive set of operating procedures & processes

- A comprehensive set of tools
- A comprehensive set of training tools
- Improved logistics
- Improved understanding of legal, ethical and social issues in major emergency management
- Improved cross-border co-operation
- Improved understanding of public acceptance in major emergency management

The main outputs of the PULSE may be summarized as:
- PULSE Tools
- PULSE Models
- PULSE Methodology

2.3.1 PULSE Decision Support outputs

PULSE developed a set of seamlessly integrated tools, assembling a platform for the management of the major medical emergencies.

PULSE decision support platform is comprised by:
- **DSVT-Decision Support & Validation Tool** [1]: This tool supports the definition and optimization of the contingency plans during the preparedness phase. It will support the decision makers with a quantitative assessment of the possible options.
- **IAT-Intelligence and Analysis Tool** [2]: This tool focuses on weak signal detection in order to alert decision makers to the occurrence of an unusual biological event. In addition, this tool also supports the decision making process by providing a prediction of the scenario evolution.
- **LT-Logistics Tool** [3]: This tool supports the decision makers in assessing the required stockpiles of any necessary equipment, medications, vaccinations etc.
- **SCGT-Surge Capacity Generation Support Tool** [4]: This tool aims at providing support for the creation of surge capacity in the event of a major health crisis focusing, amongst other things, on the coordination of the use of volunteers and of cross border assistance and taking into account the legal implications.
- **PCET-Post Crisis Evaluation Tool** [6]: This tool helps in the identification of the lessons learned by supporting the evaluation of the effectiveness of the plans implementation and by providing a view of the benefits that would be achieved with different approach/procedures/quantity/quality of resources.
- **ENSIR-Event Evolution model for Biological Events** [7]: This tool is the implementation of a mathematical model of epidemics evolution. The model will be an extended version of the classical SIR

(Susceptible - Infected - Removed) models: a class of disease spread models where individuals are susceptible to a disease, contract the disease and then either recover, becoming immune to future infections after recovery, or die from the disease.

- **Smart phone Apps**. Smartphone Apps are used by decision making personnel at the casualty clearing station, for both data input and the visualization of information; functionalities include support for patient triage (check lists, step by step dynamic triage). A casualty bureau app was also developed to assist with the identification of casualties by concerned family and friends

PULSE training tools:

- **TT-Training Tools** [5]: This set of tools support the implementation of the training methodologies. The developed tools include a MPORG (Multiple Player On line Role Game) training platform and a LMS (learning management system). MPORG users could be not only decision makers, but also operational roles, because they create "real" input environment for the decision makers. Both LMS and MPORG should be usable also by experts in order to extract feedback information for standard operational procedures updates and lesson learned.

2.3.2 PULSE Models

PULSE developed a suite of models/simulations and analysis tools in order to provide support for the key personnel for their decision making process:

- **Patient model** [8]: calculates the effects of injuries of several types on victims, and the corresponding effect of treatment.
- **Health care effect model** [8]: the model of the first aid personnel activities in case of health incidents.
- **Health care facilities model** [8]: the model of the hospital capacity, health care effect, hospital surge capability and timing.
- **Event evolution models for biological events** [8]: mathematical model of epidemics evolution.
- **Scenario generation** [9]: synthetic simulated environment with realistic scenarios for exercises.
- **MPORG**: building of game and virtual reality training background.

2.3.3 PULSE Methodology

Current national as well as EU-level (ECDC) and worldwide (WHO) healthcare systems and regulations have been analysed in order to lay the foundation for the development of a framework of procedures which will provide the

functionalities of the PULSE system, its platform and integrated tools. To outline the requirements and standards for managing key tasks in major emergencies, six core procedural areas [10] (as depicted in **Figure 2**) are considered the most important for PULSE:

1. Intelligence and information gathering
2. Threat and Risk Analysis, Warning and Alerting
3. Operational Picture and Situational Assessment
4. Task and Resource Planning, Logistics and Stockpiling
5. Training and Exercising Capability
6. Knowledge Management

Figure 2 PULSE Methodology

These core areas are linked together in a revolving cycle, feeding and receiving information and data, mutually dependent on each other. Over and above, all areas are functionally interconnected by the continuous management of knowledge.

3   The markets

3.1 Market definition

Generally, the decision support systems based on analysis systems and computer tools are more and more common in economic and social life. Although in some domains this type of systems are already being used, such as military or security domains, in the health crisis management field are not yet used on a large scale. This gap is addressed by PULSE which targets all actors involved in the healthcare and the emergency interventions. The exploitation activities will address both public and private sector.

The market segment isn't clearly limited to one of the above mentioned results but it broadly covers the healthcare and emergency management. The most immediate market areas are: local and central public authorities, emergency services, hospitals, among others.

It is necessary to segment the market according to the different goals and environment where the system will be employed, as well as to identify

relevant to which the PULSE outputs should be marketed to.

In respect to the estimated time to market, PULSE system is at a development stage which is not sufficiently advanced for opening a market. This opening may not be expected before the achievement of the future developments aimed basically to increase robustness, support to local languages and conventions, interoperability with local existing tools, training and documentation, which may realistically require a couple of years from the end of the project.

Market trends from the societal perspective

We see several factors affecting the trend with regard to the application of ethical, legal, social impact assessments (ELSAs) of new technologies and services, such as those of PULSE. First is that it is becoming more widely accepted among policy-makers and the private sector that ELSAs should be conducted whenever anyone can see ethical, legal or social impacts arising from the development of new technologies and services, such as those developed in the PULSE project. Second is that the acceptance of doing an ELSA depends on how easy and practical it is to conduct the ELSA. Experience and contacts show that most organisations want a short and simple guidance on the process of conducting an ELSA and what an ELSA report should contain. Third is that most organisations where there is need of an ELSA see the benefits of consulting stakeholders in some fashion or other. Fourth is that there will be increasing regulatory interest in and oversight of the conduct of ELSAs. The European Commission frequently wants to see the conduct of an ELSA in the projects it funds and that has given a significant impetus to the acceptance of the need to conduct ELSAs. The new General Data Protection Regulation (GDPR) also gives an important impetus to at least a data protection impact assessment (DPIA), which can provide the backbone (the structure) of an ELSA.

3.2 Potential customers

The PULSE tools, models and methodology were designed and developed considering the requirements from a large domain of end-users, from medical and emergency management domains.

The main target customers for PULSE are:

- Emergency Management Agencies,
- Public Health Authorities,
- Public Sector Decision Makers,
- Medical Officials and Scientific Community,
- Software development companies,
- Organization ensuring humanitarian protection and assistance for victims in response to major emergencies.

PULSE offers support for the improvement of the health services in both preparedness and response stages of a major medical incident, leading to a more efficient emergency management. PULSE provides validated procedures, adequate to improve the operation and success of the healthcare system in challenging disaster situations where combined operations are required at local, regional, cross border and international levels.

Public Sector Decision Makers includes institutions and authorities working in crisis and emergency management at technical or solution level, as well as decision makers in the different government bodies and authorities (e.g. health care, crisis and emergency management, etc.). PULSE supports key decision makers, by integrating a suite of models/simulations and analysis tools able to provide insights into the collective behaviour of the Health Services.

The software development companies can be partners in adapting the system to the specific local requirements, to commercial exploitation as well as to installation and system maintenance.

Table 1 Potential customers

Benefits expected from PULSE	Typical User/Customer to be addressed
Improved preparedness of Health Services	Planners & conceptualists of hospitals; local health services
Improved response of Health Services	Operators & operations control of health services & hospitals
A comprehensive set of operating procedures & processes	International bodies of standardization and of cooperation regulation
A comprehensive set of tools functional operations support	all
A comprehensive set of training tools	All, incl. first responders
Improved logistics	Hospitals, healthcare laboratories, stock keeping agencies (national and international)
Improved understanding of legal, ethical and social issues in major emergency management and in the implementation and use of a PULSE-like system	Governments; human rights org. legislation; data protection and ICT security agencies
Improved understanding of public acceptance of such system, data capturing and	Politicians at all levels (local, regional, gov., EU

managing in major emergency management	
Improved International exchange and coordination	Neighbouring nations, EU, UN

4 PULSE Exploitation Plans

4.1 Identification of the exploitable results

4.1.1 Overview table

Into the next table we are summarizing the exploitable items, as identified for each of the project's objectives (presented into chapter 2.12.1 PULSE Objectives):

Table 2: Exploitation items according to the projects objectives

ID	Project Result	Exploitation Item	Partners
OBJ1	To develop a standardised approach to improve preparedness, response and decision making across Europe for specific major medical emergencies.	• Status quo analysis of the European health system, both national and at EU level	• CESS, UCSC, OST, HSE
OBJ2	Provide an EU wide operational and technical framework to enable risk managers to undertake a threat analysis situation assessment and forecast and to react accordingly with effective decision making, resources and logistics planning, assignment and control.	• A set of standard operational procedures (SOPs) for the PULSE system	• CESS, HSE, UCSC, FINM, SKY
OBJ3	Develop innovative technology and tools to support preparedness, response and decision making and present a common operational picture to emergency	• Development of a platform for decision making based on up-to-date web technologies for real-time monitoring of hazardous scenarios and visualization of incident updates. • Development of enhanced screen sharing functionality able to facilitate the	

		collaboration between the platform's users	
		• Development an early warning system that is able to alert decision makers to the occurrence of an unusual biological event based on clinical record and Twitter messages NLP analysis	•UCSC •OST •SKY
		•SMARTPHONE APPS for triage and missing persons	
		•MPROG training tool and Learning management system	
		• Definition of an algorithm for the calculation of the optimized dispatch of casualties to hospitals. • Development of innovative approach for post crisis evaluation based on structured storage and retrieval of the incident information.	
		• ENSIR model prototype	
		• Module for merging publicly available data sources for population distribution and estimation and display of the population density	
OBJ4	Identify how improved legislation, directives and guidelines across Europe could improve decision making, preparedness and co-operation across. The protection of human rights and social norms.	• Ethical impact assessment methodology • Legal, ethical, privacy, policy issues relating to public health emergency management and health systems	•TRI

OBJ5	Develop an open operational and technical platform which will define, develop and validate procedures and processes, develop architecture and a set of technologies and tools to improve –by design– the preparedness, reliability and preparedness of European states to manage a medical crisis	• Provide method and a prototype tool • Develop and agree on a series of evaluation questionnaires • Develop and agree on a set of EELPS categories and criteria • Perform EELPS questionnaire and sample tool evaluation • Evaluation results and feedback from various stakeholders	• CESS • SKY • CESS, OST, TRI • TRI, CESS • CESS, OST, TRI
OBJ6	Develop a draft suite of European standard for large scale medical emergency including 'common vocabulary and definitions' – suitable for Europe and an integral part of our dissemination strategy.	• Study and integration of well-known standards for incident communication (e.g. EDXL-HAVE)	• FINM
OBJ7	Promote PULSE and the project results – timely and efficiently disseminate the project results; implement feasibility study and environmental analysis for effective exploitation of the project results.	• A set of brochures, newsletters • Articles in scientific journals and general public media • Market analysis for an effective exploitation of the project results	• OST • All • OST

Each exploitable item identified above is further detailed into the next table.

Table 3 Exploitation Items classification

EI	Exploitation Item	Classification	Business Exploitation	Academic Exploitation

1	Status quo analysis of the European health system, both national and at EU level	Analysis	All	All
2	A set of standard operational procedures (SOPs) for the PULSE system	Analysis	All	All
3	Development of a platform for decision making based on up-to-date web technologies for real-time monitoring of hazardous scenarios and visualization of incident updates.	Tools	FINM SKY	
4	Development of enhanced screen sharing functionality able to facilitate the collaboration between the platform's users	Tools	FINM SKY	
5	Development an early warning system that is able to alert decision makers to the occurrence of an unusual biological event based on clinical record and Twitter messages NLP analysis	Tools	FINM SKY	
6	Definition of an algorithm for the calculation of the optimized dispatch of casualties to hospitals.	Tools	FINM SKY	
7	Development of innovative approach for post crisis evaluation based on structured storage and retrieval of the incident information	Tools	FINM	
8	ENSIR model prototype. ENSIR performs the prediction of the spatial-temporal evolution of an epidemic, taking into account different factors, allowing for disease spread with different rates depending on the geographic, social and logistic characteristics of the interested area(the number/density of population in the interested area, the 'natural' connectivity of population, which may depend on the geography of	Tools	UCSC, OST	UCSC

	the area, the connectivity by means of transportation, daily flights, etc)			
9	Module for merging publicly available data sources for population distribution and estimation and display of the population density	Tool	UCSC, OST	UCSC
10	Ethical impact assessment methodology	Methodology	TRI	TRI
11	Legal, ethical, privacy, policy issues relating to public health emergency management and health systems	Methodology	TRI	TRI
12	**Method and a prototype tool for evaluation** of such a complex system under the aspects of: 1. effectiveness; 2. performance characteristics; 3. adequacy and flexibility to different scenarios; 4. ethical, economic, legal, political, societal restrictions and impacts (EELPS), 5. technical quality	Tool and methodology	CESS	
13	Develop and agree on a series of **evaluation questionnaires**	Tool and methodology	CESS, TRI, OST	CESS, TRI, OST
14	Develop and agree on a **set of EELPS categories and criteria**	Tool and methodology	CESS, TRI	TRI
15	Perform EELPS questionnaire and sample tool evaluation	Tool and methodology	TRI	TRI
16	Evaluation results and feedback from various stakeholders	Tool and methodology	CESS, TRI, OST,SKY	CESS, TRI, OST, SKY
17	Study and integration of well-known standards for incident communication (e.g. EDXL-HAVE)	Tools	FINM	
18	A set of brochures, newsletters	Dissemination materials	NA	All
19	Articles in scientific journals and general public media	Dissemination materials	NA	All

| 20 | Market analysis for an effective exploitation of the project results | Exploitation material | All | All |

4.2 Individual PULSE Partners Exploitation Plans

4.2.1 General aspects

In terms of exploitation strategies, we can differentiate between three different types of partners in PULSE consortium: Technological and industrial partners, Research and Universities, Agencies and SMEs. Depending on the type of partners, the exploitation interests and impact are different.

Technological and industrial partners

PULSE technological stakeholders focus their exploitation activities on improving their current business position in existing markets or as a preparation for the inclusion in new markets.

The technological stakeholders' main objective is to create new products and services, or to improve their products, for already existing or incipient markets based on the project results. The resulting acquired experience and expertise for participating in PULSE will provide an essential advantage over competitors. PULSE stakeholders will be better prepared for new markets, products, and services and can position themselves early on. This must be ensured by transferring results from the research departments of our industrial partners directly to development, products, marketing and maintenance departments.

Academic partners

The exploitation goals of academic partners (i.e., universities and research institutions) are complementary to those of industrial partners.

Technical developments will be integrated quickly into the teaching curricula and research agendas of our partners, giving themselves as a competitive edge, especially with respect to other universities. Academic partners will also make sure that these developments are carried into future national and international research projects, deeply rooting PULSE results in research and development activities.

By publishing papers about the PULSE results in different events as congresses, symposiums, newspapers, WebPages academic partners will obtain international visibility and improve their position in attracting the best international PhD, Master and graduate level students to their institutions.

The academic exploitation of strategic guidelines naturally has a longer time horizon than the one of the industrial partners.

Agencies and SMEs

The main objective of agencies and SMEs is to produce devices ICT, procedures, models and services using procedures / tools / applications resulting from the project PULSE.

Elaboration of Business Plans

Even if the business plans usually begin after the end of the project, it is a good exercise to plan in advance the activities to be carried out the day after the end of PULSE, to anticipate any problem that may arise in the future, and to handle it properly.

The next section elaborates each one of the individual business plans, and for each the following information is provided:

- **Institution's background.** General information of the companies/institutions involved their strategic and financial goals, cooperation and partnerships, and a brief description of the products and services they offer to their customers.
- **Exploitable results and strategy.** Description of the exploitable outcomes in connection with PULSE, identification of owners, IPRs, and other issues, planning for exploiting the results.
- **Commercial contacts and target groups**. Potential customers and clients to which the solutions developed by PULSE will be targeted.
- **Risks and risk management strategy**. Information on economic risks, organizational risk and legal risk.
- **Implementation strategy**

4.2.2   Technological and industrial partners exploitation

4.2.2.1   Skytek

4.2.2.1.1 Company background

Skytek has been a leading developer of information and operation-based software tools that allow clients like NASA, ESA , Airbus Defence and Space and other leading national and international organisations to manage and co-ordinate their information assets. Skytek has developed specialist expertise in the design of process management systems, data fusion and distributed system integration using the latest and emerging technologies. Skytek has received awards from NASA for outstanding innovation in the development of software solutions.

Our research and development team is at the heart of Skytek's success. Skytek create powerful and innovative software applications, attuned to specific commercial needs of the Space Aerospace, and Security sectors to create areas of process efficiency and competitive advantage for our clients.

Since its foundation in 1997, Skytek has built a world class software product development team with a strong R&D programme that focuses on emerging

internet standards and languages to provide interfaces that are intelligent, platform-independent and adaptable.

Our long standing relationship with our international client base is testimony to the quality of our technology and our ability to deliver the right solution when and where it is needed. Our clients continue to return to us, which has resulted in several long standing technical partnerships. For example, Skytek's iPV (International procedural viewer) has been on board the International Space station since 2005. iPV is the process management system that controls and manages each astronaut's tasks, ranging from routine daily maintenance to safety of life/mission critical tasks. The system provides astronauts with relevant procedures and support services to assist with task execution.

The company is privately owned by the company directors. It is headquartered in Dublin, Ireland, with representative offices in England & Germany.

4.2.2.1.2 Exploitation results and strategy

EI	Exploitable result	Aims of the strategy	Target market
3.1	SMART Phone apps	• Integrate PULSE smart apps with Skytek's current software system known as REACT	Public and private clients in the crisis management domain.
3.2	MPORG training tool	• Develop an effective training system for integration with Skytek's current REACT system • Provide a general platform for training of personnel in a range of disciplines • Develop a training system using new deployment mechanisms such as cloud SAAS	Public and private clients in the crisis management domain.

| 3.3 | On line Learning Management system | • Develop an effective training system for integration with Skytek's current REACT system
• Develop a managed LMS tailored to crisis management delivery
• Prove system in usage during PULSE trial
• Integrate with emerging LRS technologies for distributed learning solution | Public and private clients in the crisis management domain. |

4.2.2.1.3 Commercial contacts and target groups

REACT & PULSE

The Pulse platform will be an addition to Skytek's REACT system developed for the Emergency services in Europe. The REACT system (Resource for Emergency Services to Access Command and control data using satellite and hybrid Technologies) offers international emergency services an easy to use, cost effective system that provides both day to day operational supports to all categories of first responders and also operates as a crisis management tool within a regional Command and Control centre. A feature of the REACT system is that it provides secure, encrypted broadband satellite integration to ensure communication at all times for first responders at an emergency site back to a remote Command and Control centre.

REACT is one of the first emergency mobile applications developed to use the latest KA band satellite communication technology for the exchange of information between first responders, the incident site and a remote Command and Control centre.   The system provides a mechanism to improve verbal communication but also deliver data feeds between the command centre and major disaster scene.

Figure 3 : REACT system Dublin Fire Services, ireland

It is proposed that elements of PULSE system will represent an effective 'add on' to the REACT system. The system will provide a valuable addition to REACT by providing both triage and missing person apps to support the REACT system. The ability to quickly log and record casualties is an important element in major emergency management. This, in association with PULSE's powerful decision support tools, ensures that command and control and first responders can provide a co-ordinated response in the allocation and disbursement of seriously injured casualties.

The PULSE platform is an effective 'add on' to the REACT system, as it provides a complete solution to ensure that first responders and senior management can provide a co-ordinated and effective response during major medical emergencies

The merging of the REACT and PULSE systems offers MEM organisations an effective platform to manage major medical emergencies across the globe.

Amercian Red Cross

4.2.2.1.4

Skytek is currently working with Viasat (www.Viasat.com) in the USA to develop a MEM communication system for the American Red Cross to ensure they have robust satellite communication during major medical emergencies and crisis. The Pulse apps will be offered as an important service within the REACT system. It is proposed that the triage and missing person's apps will be incorporated into the REACT system for trial by the Red Cross. The MPROG and on-line LMS will also be offered as a support system to the

REACT system

Figure 4 American Red Cross

The American Red Cross is part of the international Red Cross and Red Crescent network is the largest humanitarian network in the world with a presence and activities in almost every country. The network is made up of all the national and international organizations around the world which are allowed to use the Red Cross or Red Crescent emblem. It also represents all the activities they undertake to relieve human suffering throughout the world.

The project known as REACH will commence in early 2017 and will be a short 6 month demonstration project. The Red Cross project is an exciting test opportunity for the Pulse Platform tools and an important showcase project for the international NGO community.

4.2.2.1.5 Risk and risk strategy

Type of Risk	Risk 1- 100% (low to high)	Reasons and Justification
Design Risk	30	- REACH building upon PULSE & REACT framework - Competence of technical team - Proven ability of the consortium for technical innovation
Manufacturing Risk	30	- Industry knowledge and expertise of Red Cross in crisis management processes - Proven ability of Skytek for technical

		innovation
Marketability Risk	40	• Involvement of Red Cross • Reputation of Viasat & Red Cross • Skytek Relationship with ESA, EU & NASA
Profitability Risk	20	• Level of competition • First to market advantage
Growth Risk	40	• Level of competition for REACH • Satellite market penetration

4.2.2.1.6 Implementation strategy

REACH/Red Cross Project:

1. Market application for Skytek system: The REACH system provides a high profile application for Skytek's technology within the MEM mobile industry. It also affords Skytek the opportunity to work with ViaSat a leading supplier of mobile broadband communication in the USA market

2. Introduction to the US market: Skytek key customer in the USA is NASA. Over the past six months Skytek has been planning an expansion into the USA. The REACH project provides Skytek with a valuable 'showcase' introduction into the USA market.

3. Niche market: The mobile market is a niche market, ideal for a small company entering the USA. The planned initiative is with a prestigious USA NGO. The majority of US states operate MEM remote units, so there is the opportunity in association with ViaSat to roll the technology out across the USA and beyond. ViaSat have the service contract with the Australian government for the single KA band satellite covering all of the Australia continent, this provides the perfect foothold for the marketing and deployment of this solution to both city and rural areas within this marketplace.

4.2.2.2 Leonardo Finmeccanica

4.2.2.2.1 Company background

Leonardo S.p.A. (former Finmeccanica) is a global player in the high-tech sectors and a major operator worldwide in the Aerospace, Defence and Security sectors. Leonardo is based in Italy, has about 47,000 employees (latest update 11/30/2015), of whom about 37% abroad, and in 2014 recorded 14.6 billion euro in revenues and received orders in the amount of

15.6 billion. Based on the dual application of technologies, Leonardo designs and creates products, systems, services and integrated solutions both for the defence sector and for public and private customers of the civil sector, both in Italy and abroad.

The wide range of defence and security solutions that Leonardo offers to Governments, private citizens and Institutions includes every possible intervention scenario: airborne and terrestrial, naval and maritime, space and cyberspace. In close contact with local customers and partners, Leonardo works every day to strengthen global security, provide essential physical protection and cybersecurity services for people, territories and infrastructure networks and supports scientific and technological research.

Leonardo operates in about 20 countries with offices and industrial plants in all of the five continents and can rely on a very large network of subsidiaries, joint ventures and international partnerships, with significant industrial presence in three main markets, United Kingdom, Poland and United States and structured partnerships in the most important high potential markets in the world.

Leonardo S.p.A. is the culmination of a radical renewal and transformation process: from a financial holding company to a great integrated industry focused on four activity sectors: Helicopters, Aeronautics, Electronics, Defence and Security Systems, Space. Leonardo operates through seven divisions that have inherited the activities of its 100% owned companies (AgustaWestland, AleniaAermacchi, Selex ES, OTO Melara and WASS): Helicopters, Aircraft, Aerostructures, Airborne & Space Systems, Land & Naval Defence Electronics, Defence Systems, Security & Information Systems.

4.2.2.2.2 Exploitation results and strategy

In the following the exploitation strategy behind the exploitation items, defined in 4.1.1, is explained.

EI	Exploitable result	Aims of the strategy	Target market
3.1	Development of a platform for decision making based on up-to-date web technologies for real-time monitoring of hazardous scenarios and visualization of incident updates.	The concrete exploitation of the developed platform is currently under evaluation inside the divisional marketing team. The feedback from that team about the PULSE platform was very positive, confirming the good impression had in preceding presentations, and once this preliminary	Public and private clients in the crisis management domain.

		filter is passed the innovation results are in the path to be inserted in a set of potential future products. The strategy for exploitation of this item is more detailed in section 4.2.2.1.5.	
3.2	Development of enhanced screen sharing functionality able to facilitate the collaboration between the platform's users	The acquired knowledge on enhanced screen-sharing functionality is not related to a specific domain. This will be used by internal FINM delivery teams inside other company's products, even in areas not related to the crisis management domain.	Internal development
3.3	Development of an early warning system that is able to alert decision makers to the occurrence of an unusual biological event based on clinical record and Twitter messages NLP analysis	The acquired Natural Language Processing expertise can be adapted in different exploitation domain. For this reason, the FINM plan is to consider the integration of such technology in already existing company's products.	Internal development
3.4	Definition of an algorithm for the calculation of the optimized dispatch of casualties to hospitals.	This algorithm is expected to be a crucial asset not only in the health-related domain but also in more general crisis management applications. For this reason, the FINM's plan is to consider a possible adaptation and integration of this algorithm in internal	Internal development

3.5	Development of innovative approach for post crisis evaluation based on structured storage and retrieval of the incident information	The innovative approach for post crisis evaluation will be exploited in other internal product systems and will be further improved and adopted in other crisis management-related research projects (e.g.,this tool is envisaged for reuse – while adapting its functionality and further increasing its maturity level - in the Reaching Out project funded under H2020, where FINM is one of the consortium partners)	Internal development. Reuse – with higher maturity level - in other research projects
6.1	Study and integration of well-known standards for incident communication (e.g., EDXL-HAVE)	The acquired knowledge on incident communication standards will be exploited in future research projects and in internal software developments. It is also possibly reused inside Reaching Out project funded under H2020, where FINM is one of the consortium partners, who is related to protection of assets and citizens out of European boundaries in case of health disasters.	Internal development. Reuse – with higher maturity level - in other research projects

4.2.2.2.3 Commercial contacts and target groups

The target market of FINM as a whole is the worldwide market area of primary industrial and service companies, public administrations and national departments, for the design and production of systems, services

and solutions in defence, automation, security, transport, and information technology.

FINM envisages that the PULSE prototype will be used initially by selected stakeholders for a free-trial period and that the same prototype will be extended, documented and adapted according to the gathered stakeholders' suggestions before proposing it to the general market. The product will be then inserted into the company's catalogue of software integrated solutions towards new and consolidated customers in the crisis management and emergency market domain (e.g., National security and healthcare authorities, medical/hospital representatives).

4.2.2.2.4 Risk and risk strategy

PULSE provides an innovative approach in a context (crisis management)that requires strict and precise collaboration among different stakeholders (e.g., the National security and healthcare authorities and medical/hospital representatives at local and/or European level according to the usage scenario)and, in order to guarantee this cooperation among different organizations, there are in place a number of roles, rules and methodological procedures covering most part of the activities related to crisis management.

This complex environment can be considered a risk for the exploitation of the PULSE platform that requires one the one hand a wide compliance with existing rules and procedures and on the other hand the individuation of a specific marketing strategy in order to limit the possible bad outcome of the platform exploitation.

For what concerns the compliance rules and procedures, this has been dealt with during the full lifetime of the PULSE project, by studying current international SOPs and by taking into account those SOPs during the software development of PULSE components.

For what concerns the marketing of the PULSE platform, the approach that is currently under evaluation inside the FINM marketing team is to establish, since the beginning, an intense collaboration with a limited number of important and relevant stakeholders in the reference domain, in order to let them test the tools with the support of a FINM development team, to fix together the current weaknesses and to facilitate the introduction and the acceptance of the platform in the market.

4.2.2.2.5 Implementation strategy

The plan for the exploitation of the developed platform is currently under evaluation inside the FINM marketing team. The evaluation process is currently at this stage:

1. Once sufficiently mature and demonstrated during the PULSE field trials, the developed platform has been presented and proposed for exploitation to the divisional team of people who take care of evaluating the results of research activities for marketing purposes. (There is a different marketing team for each of the three company

divisions. The market team who is responsible for the evaluation of PULSE research and innovation items is inside the Security and & Information Systems division- the same company division where the PULSE researcher work).

2. The feedback from the team was very positive, confirming the good impression had in preceding presentations.

3. Once this preliminary filter is passed the PULSE platform (i.e. the suite of interworking tools developed in PULSE) has been inserted in a restricted set of potential future products, for which IPR protection and – after - a concrete commercial exploitation is considered as viable.

The way before having a commercialization is still long and costly (e.g., there is the need to work on documentation, training, comprehensive error reporting, improvement of interfaces and so on).

The intentions to invest in the further development of the platform with the help of selected external domain-related stakeholders. The basic idea is to let selected external important domain-related stakeholders to freely use the platform for a limited amount of time (e.g., 1 year). During this period, FINM plans to acquire relevant feedbacks and to track and fix possible bugs possibly present in the platform prototype. Moreover, during this period the necessary documentation and training in support to future customers using the platform will be produced.

After this preparation period, the platform will be mature enough to be commercialized and a proper usage license will be issued. In order to maintain the fruitful collaboration with the stakeholders that were involved in the long test period, there is the chance that an agreement will be signed in advance with them, to let them keep on using the platform with favourable conditions, possibly after the subscription of a usage-fee.

Finally, FINM's individual exploitation plan considers also the possibility to internally reuse some parts of the knowledge and concrete results obtained in the project, in one of the many different ICT areas where FINM is involved. In concrete, there is the chance to integrate some of the PULSE tools inside some of the division's Homeland Security products, in order to complete the functionality of company's portfolio for the security management of big events, just like the recent 2015 Milan Expo[1].

4.2.3 Research institution and universities exploitation

4.2.3.1 UNIVERSITA CATTOLICA DEL SACRO CUORE

4.2.3.1.1 Company background

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[1] http://www.leonardocompany.com/en/product-services/sicurezza-infrastrutture-critiche-security-critical-systems

The Catholic University (UCSC – Università Cattolica del Sacro Cuore) is an Italian Academic institution founded in Milan in 1921. The School of Medicine of UCSC provides healthcare at the Policlinico Universitario "A. Gemelli" in Rome, with 1400 beds and a turnover of 70.000 patients annually, providing all clinical specialties. The activities are articulated in research, training and healthcare. As well as the School of Medicine and related professional schools, the UCSC has its School of Health Management. The Emergency Department (DEA) is a large structure through which all emergency cases access the hospital. It includes Emergency Rooms for medical and surgical specialities (including trauma), adult and paediatric Intensive Care, Emergency Medicine Ward and a Poison Centre providing a 24 hour emergency telephone assistance line. The DEA includes a Helipad habilitated for 24/7 landing of airborne ambulances.

There also are Departments of Microbiology and Virology, of Infectious Diseases and of Radiological Surveillance and Applied Physics. Several educational activities are carried out to train health care professionals in many fields of emergency medicine. In addition, within the Medical School, there is an Advanced Trauma Life Support (ATLS) centre with a Faculty recognized by the Committee on Trauma of the American College of Surgeons (ATLS is a protocol which is taught and recognized throughout all of Europe as well as in the USA and worldwide) and a Hazmat (Hazardous Materials) reference centre.

The Medical School is self-sufficient in providing ERC (European Resuscitation Council) courses for training in cardiopulmonary resuscitation and emergency cardiac care: Advanced Life Support (ALS), Intermediate Life Support (ILS), Basic Life Support and Defibrillation (BLSD), European Paediatric Life Support (EPLS), European Paediatric Intermediate Life Support (EPILS). In 2005 the Policlinico Universitario "A. Gemelli" was one of the parties of a program (involving hospitals, police forces, Fire Department, ambulance and emergency medical services) which simulated a terrorist attack and tested the response capability of the system as a whole. Together with the National Council of Research UCSC participated in European programs HEARTS (Health Early Alarm and Telemonitoring System) funded under FP5(IST) and SICMA (Simulation of Crises management Activities) funded under FP7 (SEC). Since 2009, the Policlinico Universitario "A. Gemelli" is a member of the Rome Task Force for Civil Defence. In particular the group directed by Professor Daniele Gui, Director of the Emergency Surgery Unit and Responsible for Trauma and Emergency related activities, is active in research on Trauma, Pathophysiology of Shock by means of biomathematical modelling, simulation processes and the study of end-user requirements.

4.2.3.1.2 Exploitation results and strategy

UCSC has worked principally on the Decision Support part of the PULSE Platform together with SES/Leonardo. UCSC has lead the End User Requirement gathering through its multiple contacts with End users from National, Regional, Local Public Health Institutions, EMS, Fire Brigadeand Security Agencies. Exploitation on USCS part will be the connection with

existing Projects such as EDEN (FP7), with a possible introduction of the PULSE platform into the EDEN Store (that will be maintained possibly by future Projects related to the SEC 05 (2016) on Cluster building in the CBRNe market). PULSE platform will be also upgraded and tailored, especially for the part pertaining to the epidemiological response in case of pandemics in the just initiated project REACHING OUT (Horizon 2020) where in the WP6 Demo on Ebola crisis in West Africa the DSS will be tailored for this infective disease in rural settings. The DSS system will also be integrated with other tools such as mobile Labs (UCL, Université Catholic de Louvaine). Partners of REACHING OUT project are also FINM FINMECCANICA - LEONARDO.

The PULSE DSS will also be further developed together with the Instituto Spallanzani of Rome – Istituto Nazionale Malattie Infettive, responsible for Epidemiological Surveillance of the City of Rome, with whom the PULSE Emerging Viral Disease Trial was carried out in July 2016. INMI has a strong interest in further collaboration and in possible adoption of the PULSE system for institutional functions. Together with the INMI further bids will be placed for Italian Regional Funding in the coming months.

An interest towards the PULSE Platform has been expressed to UCSC also by the OSDIFE (Osservatorio sulla Sicurezza e la Difesa CBRNe, Rome) on its possible use for Chemical Risk Mapping on the Italian Territory. Further contacts are pending at the moment.

4.2.3.1.3 Commercial contacts and target groups

UCSC is a University and an End-User Hospital. Its contacts and target groups are other Universities and Entities interested in Public Health and Emergency and Disaster Management Research. As a Major Hospital UCSC-Policlinico Gemelli has contacts with other Hospitals, a series of first responders such as EMS, Fire Brigades and Security officials, CBRNe Centers.

4.2.3.1.4 Risk and risk strategy

No dedicated risks can be identified in exploiting the PULSE results according to the nature of UCSC.

4.2.3.1.5 Implementation strategy

The implementation of PULSE results by UCSC will mainly be the use of the knowledge gained from the project in future medical/emergency management domains. This includes planning and setting up of experiments and capturing and evaluation of the results of trials, experiments and exercises. A focal issue will be the further improvement and application of the DSS to different epidemiological diseases and CBRNe related threats.

4.2.4 Agencies and SMEs exploitation

4.2.4.1 CENTRE FOR EUROPEAN SECURITY STRATEGIES

4.2.4.1.1 Company background

CESS is an SME that focuses its main business on security planning, consulting and decision support. For almost 10 years, CESS has been involved in numerous national, EU and international security projects. The main activities and skills applied include

- Security requirements analyses and medium-to-long-term strategies and concepts for public and commercial security planners and decision makers
- Development of future scenarios, test and demonstration environments
- Design of methodologies for the improvement of concepts and solutions of disaster and crisis management, gaming, exercising and training, critical infrastructure protection
- Methods and tools for the socio-political evaluation of security measures
- Methods and tools for the evaluation of the effectiveness and performance of new security measures
- Assessment and evaluation of results of security related projects.

4.2.4.1.2 Exploitation results and strategy

As CESS mainly applies brainwork (concepts, analyses, consultancy), the main exploitation from PULSE is the application of methodologies developed in the project for the demonstration of complex security software solutions. Methodologies developed and applied include

- Application use cases derived from the scenarios
- Planning and setting up of trial experiments and exercises
- Schemes and templates for information capturing (e.g. questionnaires; structured/moderated discussion schemes)
- Methods and tools for statistical evaluation and analysis of feedback results

Methodologies have been documented mainly in PULSE D5.2, D7.1/.2/.3.

A dedicated methodology and tool has been developed in close cooperation of PULSE WP5; 7 and 8 for the evaluation of the PULSE system with respect to its expected ethical, economic, legal, political and societal implications (EELPS). This "qualitative criteria assessment" (QCA) has been developed for and is applied in PULSE and in several on-going security projects.

4.2.4.1.3 Commercial contacts and target groups

The PULSE project approach, scenarios and use cases, trial results and evaluation framework have been extensively presented to and discussed

with a large number of external stakeholders: National security and healthcare authorities, medical/hospital representatives, universities etc. Details of the stakeholder trials events are documented in D7.2, results in D7.3.

4.2.4.1.4 Risk and risk strategy

No dedicated risks can be identified in exploiting the PULSE results according to the business model of CESS.

4.2.4.1.5 Implementation strategy

The implementation of PULSE results by CESS will mainly be the use of the knowledge gained from the project in future security-related business. This includes planning and setting up of experiments and capturing and evaluation of the results of trials, experiments and exercises. A focal issue will be the further improvement and application of the aforementioned EELPS method.

In addition, when it will come to commercial exploitation of the PULSE platform or of components of it, CESS will be ready to enter exploitation partnerships with PULSE partners who developed the software (e.g. FINM Leonardo - Finmeccanica; Skytek). For these cases, CESS offers conceptual support and marketing support for tailoring the PULSE platform to customer needs, in use case and test design, and for system demonstration and evaluation.

4.2.4.2 Trilateral Research

4.2.4.2.1 Company background

Trilateral Research Ltd (TRI)[2] is a London-based research company (SME) with expertise in privacy and data protection, ethics, security and surveillance, crisis and disaster management, and data science. Trilateral's team represents a variety of disciplines: sociology, anthropology, science & technology, and law. Trilateral Research offers a range of services including impact assessments, policy & regulatory advice, research services, technology assessment, data services and training. Trilateral offers a range of impact assessments for the private and public sector that offer organisations an opportunity to explore, asses, analyze and mitigate a wide range of risks. Trilateral has organised consortia with representatives from industry, universities, government agencies, research institutes and civil society organisations. Almost all of Trilateral's staff has post-doctoral research experience. Trilateral works with its clients to assist them in developing robust strategies for exploiting their products or services. Trilateral also offers bespoke training sessions or packages across areas of expertise, e.g. 'Master classes' and other forms of tailored training for experts and practitioners looking to further develop their organisation's

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[2] http://trilateralresearch.com/about-us/services/

practice in key areas.

4.2.4.2.2 Exploitation results and strategy

Trilateral leads *WP8 - Legal, Ethical and Societal Impact* in PULSE. Within the context of its work within WP8, it proposes the following:

EI	Exploitable result	Aims of the strategy	Target market
4.1	Ethical impact assessment methodology (as refined through use in PULSE) including the ethical risk assessment (of the tools)	To foster the use of the methodology in conducting ethical impact assessments in a wide variety of research projects where ethical impact assessment is called for. To leverage the use of this methodology further to support our consulting services and generate further business for, e.g., by developing bespoke services for clients.	Public sector and private sector clients
4.2	Findings of WP8: Legal, ethical, privacy, policy issues relating to public health emergency management and health systems	To disseminate the results of WP8 via publications i.e. journal articles (thereby helping to boost the company's visibility and profile, and generate greater business and funding collaborations.	Scientific community

4.2.4.2.3 Commercial contacts and target groups

Trilateral's clients and partners include the European Commission, intergovernmental organisations, national governments, agencies, ministries and public authorities, standardisation organisations, universities, research institutions and think tanks, industry and professional associations and civil society organisations.

4.2.4.2.4 Risk and risk strategy

The exploitation and dissemination plans outlined above are low risk.

Trilateral is well versed in stakeholder and client expectations management. Learning, improvement and adaptation processes are an inherent part of its organisational culture. Trilateral's management strategies ensure effective monitoring of the company's commitments.

In terms of any risks relating to implementing dissemination via publication, this is a low risk too. Trilateral has an excellent publications track record. Its employees have published books, book chapters and journal articles with many reputed academic and professional journals such as Science and Public Policy, International Review of Law, Computers & Technology, International Data Privacy Law, Computer Law & Security Review, etc.

4.2.4.2.5 Implementation strategy

The implementation of the strategy will pursue the following steps (not all of them are sequential, and some are iterative):

1. Finalisation of the methodology and findings of WP8 on conclusion of the project.
2. Internal webinar with TRI team on PULSE EIA methodology.
3. Pitching the use of the methodology in research proposals.
4. Advertising EIA or P+EIA (privacy plus ethical impact assessment) services to other (non-research) clients.
5. Identifying journals, writing articles, thereby disseminating WP8 research results.

4.2.4.3 HEALTH SERVICE EXECUTIVE

4.2.4.3.1 Company background

The HSE is a large organisation of over 100,000 people, whose job is to run all of the public health services in Ireland. The HSE manages services through a structure designed to put patients and clients at the centre of the organisation. The HSE Code of Governance provides an overview of the principles, policies, procedures and guidelines by which the HSE directs and controls its functions and manages its business, it is intended to guide the Directorate, leadership Team and all those working within the HSE and the agencies funded by the HSE, in performing their duties to the highest standards of accountability, integrity and propriety. The HSE Code of Governance was first approved by the Minister for Health and Children in 2007. The Code has been reviewed and updated in line with best practice and to ensure it meets the requirements of the Code of Practice for the Governance of State bodies (2009). The revised Code was approved by the Minster for Health in December 2015.The HSE has four Regional Health Forums, which includes representatives from the city and county councils within that area. The HSE's vision is for a healthier Ireland with a high quality health service valued by all. They mission of the HSE is that people in Ireland are supported by health and social care services to achieve their full potential. People in Ireland can access safe, compassionate and quality care

when they need it and that people in Ireland can be confident that the HSE will deliver the best health outcomes and value through optimising our resources.

4.2.4.3.2 Exploitation results and strategy

As the HSE mainly provides end-user perspectives to the PULSE platform, the main exploitation from the PULSE system is the application of using a mass casualty exercise developed as part of the validation strategy for the demonstration of the PULSE platform. The core principles behind designing emergency management exercises on this scale are to showcase the PULSE tools that were developed and to be tested by the Irish end-users. The exercises that were designed to demonstrate the PULSE platform are documented in D7.1

4.2.4.3.3 Commercial contacts and target groups

As the Health Service Executive is a public body, we will share the results within our professional circle. The Emergency Management office is in a unique position to share the PULSE results with our colleagues in the National Ambulance Service, Senior Management of the Health Service Executive, Public Health, the Cork Fire and Rescue services and An Garda Síochána. In addition, the Emergency Management Office will give an overview of the PULSE platform at the upcoming National Emergency Management conference.

4.2.4.3.4 Risk and risk strategy

No dedicated risks can be identified in exploiting the PULSE results according to the mission and vision statement of the Health Service Executive.

4.2.4.3.5 Implementation strategy

The implementation of the PULSE results by the HSE will mainly be the use of the knowledge gained from the project in future mass casualty events and also the use of information technology in dealing with major emergencies. This includes the planning and execution of emergency management exercises in line with the Irish Framework for Major Emergency Management. The key issue that the Emergency Management office would like to progress is the concept of utilising major emergency exercises to demonstrate and validate information technology tools.

4.2.4.4 Onest Solutions

4.2.4.4.1 Company background

ONEST SOLUTIONS is a Romanian SME, legal entity with its administrative centre located in Bucharest, Romania. The company has a team with extensive experience in developing products in the areas of data acquisition and embedded systems, integrated management systems for security, emergency management and critical infrastructure protection. The team also

has experience in participating in research and development projects in both industrial applied research and national, European research and development.

4.2.4.4.2 Exploitation results and strategy

ONEST is and R&D SME, mainly involved into software products development as well as consultancy, analysis, concepts and design. Therefore, the next steps are, mainly:

- use of the emergency management market analysis results and evaluation results and feedback from various stakeholders for a new range of products;
- use the module for population density estimation and the above mentioned analysis as reference for prototyping a new mobile application for medical services;
- use and development of the evaluation technique and questionnaires.

In respect to development strategies, ONEST is open for fostering the cooperation with PULSE partners for both new products and services development as well as for teaming for future research projects.

4.2.4.4.3 Commercial contacts and target groups

ONEST presented the PULSE project approach, developed tools, trials results to a large number of stakeholders: National security and healthcare authorities, medical/hospital representatives, universities etc. ONEST's clients and partners include industry and professional associations and civil society organizations, universities and research institutions.

4.2.4.4.4 Risk and risk strategy

No dedicated risks can be identified in exploiting the PULSE results according to the business model of ONEST.

4.2.4.4.5 Implementation strategy

ONEST will mainly use the knowledge gained from the project in future security-related business. This includes state-of-the-art analysis and requirements identification, evaluation of the results as well as promoting and presenting projects results. Prototyping and product development of web-based / mobile applications build upon mathematical and analytical models is another area of future developments.

In respect to the commercial exploitation of the PULSE, ONEST is ready to enter exploitation partnerships with PULSE partners who developed the software (e.g. FINM Leonardo -Finmeccanica; Skytek). ONEST can provide development support as well as conceptual support and marketing support for tailoring the PULSE platform to customer needs.

5 PULSE Consortium Level Exploitation Plan

5.1 Introduction

In this section it is analyzed the exploitation of the PULSE platform by the consortium as a whole, in addition to the individual exploitation plans. This exploitation requires a well-structured and clear exploitation agreement.

From the exploitation point of view, not all partners in the consortium have a specific role in the commercial exploitation of results. The objective of this section is to set the framework for the common exploitation of PULSE after the project end, defining the role that each partner will have and the exploitation activities that will be needed.

From the IPR point of view, the consortium will follow the IPR guidelines gathered in the Consortium Agreement signed by all partners in the beginning of the project.

5.2 Exploitation activities

Market deployment can start with the implementation on a limited basis, for instance in some emergency stations - selected hospitals or in a specific region (district) in countries participating in this project; after the end of this period, the market could be opened on a large scale.

In this section we identify the activities required for the exploitation of the PULSE platform after the end of the EU funded project for its introduction to the market. In the next section we'll focus on the role that each partner will play in the exploitation of the items identified above. Among the exploitable items are products that may become marketable products after several further activities, as described below. The next table gives an overview over the estimated time to market for each of the exploitable items and the activities to be performed in order to achieve this time table:

- Further research under international (H2020), national or regional research programs.
- Identification of potential customers and gathering of stakeholders requirements (meetings and workshops with end users, operators, owners and other parties relevant for that area of application).
- Software development to derive products from research outcomes (aiming to the pre-industrialization phase, the outcome reaching TRL 8).
- Deployment in an operational environment (TRL 9).

The readiness level of the tools and methodology developed in PULSE is summarized below:

Table 4 Technology readiness level

Item	Readiness level
Development of a platform for decision making based on up-to-date web technologies for real-time monitoring of hazardous scenarios and visualization of incident updates.	TRL 5 – technology validated in relevant environment
Smart phone apps	TRL 5 – technology validated in relevant environment
Mporg training tools	TRL 5 – technology validated in relevant environment
On-line learning management system	TRL 5 – technology validated in relevant environment
Development of enhanced screen sharing functionality able to facilitate the collaboration between the platform's users	TRL 5 – technology validated in relevant environment
Development an early warning system that is able to alert decision makers to the occurrence of an unusual biological event based on clinical record and Twitter messages NLP analysis	TRL 5 – technology validated in relevant environment
Definition of an algorithm for the calculation of the optimized dispatch of casualties to hospitals.	TRL 5 – technology validated in relevant environment
Development of innovative approach for post crisis evaluation based on structured storage and retrieval of the incident information	TRL 5 – technology validated in relevant environment
ENSIR model prototype. ENSIR performs the prediction of the spatial-temporal evolution of an epidemic, taking into account different factors, allowing for disease spread with different rates depending on the geographic, social and logistic characteristics of the interested area(the number/density of population in the interested area, the 'natural' connectivity of population, which may depend on the geography of the area, the connectivity by means of transportation, daily flights, etc)	TRL 4 – technology validated in lab (proof-of-concept)
Module for merging publicly available data sources for population distribution	TRL 4 – technology validated in lab (proof-of-concept)

and estimation and display of the population density	

5.3 IPR protection measures

The use of PULSE Foreground is defined in the Consortium Agreement. Respecting these premises, the consortium has prepared an Intellectual Property Rights table, which shows which partners own a result and the exploitation rights of the rest of the consortium. In this table it is shown the different types of property rights defined, namely:

- **Ownership rights (O)** The owner of the foregrounds the partner that has performed the work. If the work is made by more than one partner by common efforts and it is not possible to differentiate what has been created by whom, an agreement has to be drawn up indicating the nature of the jointed ownership of this knowledge. The coauthors will sign an ownership agreement to define how the management of the joint ownership will work. If there is no such agreement, each joint owner will be able to grant non-exclusive licenses for free to third parties, on condition that it notifies the other joint owners. In agreement with EU IPR recommendations, the owner of foreground and background can be considered to enjoy (and entitled to grant) quasi-exclusive rights to it, except for the obligation to provide access, if needed by the other participants for the purposes set out below (case U). However, the other participants can waive their access rights to allow the owner to grant an exclusive license to a third party.

- **Use rights (U)** Use rights means direct or indirect utilization – as it is with no support by the owner unless differently agreed - of the foreground created during the project in further research activities or in developing and providing a service, product or process, whenever a partner needs it for using its own foreground. These rights will be granted, on fair and reasonable conditions to be agreed, to organizations that have been working in the project even if they haven't been involved directly in the work packages where these activities belong.

The following table applies these definitions to the different exploitable results obtained from the project:

Table 5 Summary of the property rights

Ref	Item	SKYTEK	LEONARDO FINMECCANIC	UCSC	CESS	TRILATERAL	HSE	ONEST
1	Status quo analysis of the European health system, both national and at EU level	O	O	O	O	O	O	O
2	A set of standard operational procedures (SOPs) for the PULSE system	O	O	O	O	O	O	O
3	Development of a platform for decision making based on up-to-date web technologies for real-time monitoring of hazardous scenarios and visualization of incident updates. Smart phone apps, mporg do they belong here or separate section	O	O	U	U	U	U	U
4	Smart phone apps	O	U	U	U	U	U	U
6	Mporg training tools	O	U	U	U	U	U	U
6	On-line learning management system (LMS)	O	U	U	U	U	U	U
7	Development of enhanced screen sharing functionality able to facilitate the collaboration between the platform's users	O	O	U	U	U	U	U
8	Development an early warning system that is able to alert decision makers to the occurrence of an unusual biological event based on clinical record and Twitter messages NLP analysis	U	O	U	U	U	U	U
9	Definition of an algorithm for the calculation of the optimized dispatch of casualties to hospitals.	U	O	U	U	U	U	U
10	Development of innovative approach for post crisis evaluation based on structured storage and retrieval of the incident information	U	O	U	U	U	U	U
11	ENSIR model prototype.	U	U	O	U	U	U	U

Exploitable item		PARTNER						
Ref	Item	SKYTEK	LEONARDO FINMECCANIC	UCSC	CESS	TRILATERAL	HSE	ONEST
12	Population density module	U	U	U	U	U	U	O
13	Ethical impact assessment methodology	U	U	U	U	O	U	U
14	Legal, ethical, privacy, policy issues relating to public health emergency management and health systems	U	U	U	U	O	U	U
15	Method and a prototype tool for evaluation	U	U	U	O	U	U	U
16	Evaluation questionnaires	U	U	U	O	O	U	O
17	Develop and agree on a set of EELPS categories and criteria	U	U	U	O	O	U	U
18	Perform EELPS questionnaire and sample tool evaluation	U	U	U	O	O	U	U
19	Evaluation results and feedback from various stakeholders	U	U	U	O	O	U	O
20	Study and integration of well-known standards for incident communication (e.g. EDXL-HAVE)	U	O	U	U	U	U	U
21	A set of brochures, newsletters, promotional video	O	O	O	O	O	O	O
22	Articles in scientific journals and general public media	*	*	*	*	*	*	*
23	Market analysis for an effective exploitation of the project results	O	O	O	O	O	O	O

* The publication procedure and IPR are in accordance with the guidelines stated into the PULSE's Project Handbook[12] and PULSE D9.1 Dissemination Master Plan [13].

5.4 SWOT analysis

SWOT analysis is a strategic planning method used to evaluate the Strengths, Weakness, Opportunities and Threats involved in a project. This analysis is about to define the challenges of the project and identifying the

internal and external factors that are favourable and unfavourable to achieve that challenges.

SWOT analysis includes:

Strengths: PULSE's intrinsic characteristics that give an advantage over others in the current market. (Internal factors)

Weaknesses: intrinsic characteristics that place the PULSE at a disadvantage relative to other projects / companies. (Internal factors)

Opportunities: are chances to make greater sales or profits in the environment. (External factors)

Threats: are elements in the environment that could cause trouble for PULSE business. (External factors)

The following chart shows and simplifies PULSE's strengths, weakness, opportunities and threats possible to face:

<div align="center">Table 6 SWOT Analysis</div>

Strengths:	Weaknesses :
- Provides a set of advanced methodologies and tools in a single system; this increases clarity and usability of the information available during a major medical emergency - PULSE system allows rapid customisation as well as integration of new services/standards - Addresses a major gaps and improvement potential in healthcare - Takes into account all driving factors of critical health situations (Early and weak signals, dynamics of escalation, planning and resource allocation, preparedness, training & exercising, ethical and socio-political factors) - Demonstrated and validated it in two essentially different trial scenarios - Generally applicable to the developing health care	- Integration of some tools still needs improvement - For some end-users possibly a further learning process necessary - Additional effort for adaptation to other tasks in different scenarios - Requires underlying available data network. - Effort (monetary and administrative) for adaptation to national framework, introduction, training

market • Ability to integrate with independent data provision network technology	
Opportunities: • Smart apps effective 'add on' tools to current decision support system • Strong positive feedback from trial end-users and practitioners • Can support harmonizing healthcare processes across Europe • Stimulates further development of planning and decision support tools • Improves international knowledge exchange • Possible integration with satellite enabled communication system such as Skytek's REACT system • Level of MPORG innovation and LMS innovation • Support enhancement of operational procedures and processes of first responders. • Provision of distributed learning solution.	• **Threats:** • Declaration as an EU standard may be time consuming and complex process • Reluctance of decision makers to enter this new "paradigm" of decision support • Smart apps: Current legal constraints on completing missing person reports on line. Currently use fax machines. Change in process required • Budgetary restrictions in public institutions. • Complex decision making process within public sectors across Europe

Strength:

The main strength of the PULSE platform is its innovative set of tools and methodologies addressing major gaps in the European health care systems. Strength is also its scalability and adaptability since the major emergencies management issue is a complex one, involving more than the medical services and services from many countries; so, an operational implementation would require a rapid customization and integration with existing systems/services/standards.

Opportunities:

Nowadays, our society faces an increasingly number of tragedies due to deadly threats such as pandemic disease and major accidents, terror attacks or natural hazards leading to the necessity of an European platform for medical support during major emergencies. In such situations, it is critical for the European emergency medical services to be in an excellent state of

preparedness supported by first-class planning and decision support tools. Moreover, in the response phase, European emergency medical services need consistent, coordinated and standardized advanced support methods and tools providing support in critical tasks like e.g. early threat detection, common operational picture, creation of surge capacity etc. PULSE, due to its innovative approach, addresses a wide range of major emergencies management systems and can be a support harmonizing healthcare processes across Europe. It also improves the international knowledge exchange and may be a platform for further development of planning and decision support tools.

Weaknesses:

The main weakness of the PULSE platform is the need for further development mainly for integration with existing systems. Additionally, due to its complexity, it is foreseen a significant effort for adaptation to national framework, commissioning and training.

Another weakness is the dependence to availability of the Internet or public communication networks; however this will be addressed by Skytek in its forthcoming project. This issue is critical if PULSE is used at a mass casualty incident with multiple victims when, often, the public communication networks are flooded by calls and messages

Threats:

The main threat towards PULSE's future implementation is the complexity of implementation on a large scale – due to national specificity in terms of procedures, laws and technical resources - doubled by the intrinsic complexity of imposing of standard at European level. However, Leonardo has the scale to bring such a platform to the marketplace with further development

Furthermore, we must take into account that the economic public institutions are situated in a crisis period, and therefore its budget is being drastically reduced; this may lead to reluctance in adopting new technologies.

One factor that has to be taken into account is the increase of legislation about data protection and privacy; since PULSE handles and stores sensitive data, continuous alignment to this laws being mandatory.

PULSE SWOT Strategies

The following strategies are meant to foster PULSE's strengths and to maximize opportunities, while minimizing weaknesses and avoid threats.

SO – "Maxi-Maxi" Strategy

This situation is the best option, PULSE taking advantages of opportunities by maximizing its strengths:

• Taking the advantages of the good appreciations from practitioners and emergency management specialists, PULSE will be promoted as a solution for other domains where planning and decision support tools are needed.

• PULSE was developed considering all critical driving factors of health care and was demonstrated and validated widely different trial scenarios so it will be presented as a support for healthcare harmonization across EU

• PULSE allows rapid customization and integration with existing systems as well as integration of new services / standards; the platform will be promoted as an enabler for optimization of the medical emergencies management and as a solution for better medical resources management.

WT – "Mini-Mini" Strategy

PULSE has external threats which cannot be confronted on short dated; these strategies are based on minimizing the weaknesses and avoid threats:

- Developments still to be planned and implemented in order to raise the readiness level for integration with systems in use.
- Developments still to be planned and implemented for

supporting other tasks in different scenarios; a special attention will be paid to the facilities supporting a better resource management and costs reduction

- PULSE team will seek further research under international (H2020), national or regional research programs.

WO – "Mini-Maxi" Strategy

Take advantage of the market opportunities to overcome PULSE's weaknesses:

- PULSE team will seek identification of potential customers and gathering of stakeholders requirements (meetings and workshops with end users, operators, owners and other parties relevant for that area of application)

ST – "Maxi-Mini" Strategy

Take advantages of the PULSE's strengths to avoid real and potential threats present in the market:

- PULSE will be proposed as an innovative platform, enabling better resource management and more efficient cost control
- Being an open and customizable platform, PULSE will be proposed for other segments of the emergency management, having the potential to foster procedures alignment and standardization across EU.
- PULSE will be promoted as an open platform, allowing rapid customization on both medical emergency management as well as for other emergency management segments; integration with existing systems and openness for customization for arguments for approaching existing systems and for overcoming reluctance of the decision makers.

Strengths:	Threats:
• Provides a set of advanced methodologies and tools in a single system; this increases clarity and usability of the information available during a major medical emergency	• Existence of already well-known and used systems that partially provide some of the functionalities offered by the PULSE
• PULSE system allows rapid customisation as well as integration of new services/standards	• Declaration as an EU standard may be complicated
• Addresses a major gaps and improvement potential in healthcare	• Reluctance of decision makers to enter this new "paradigm" of decision support
• Takes into account all driving factors of critical health situations (Early and weak signals, dynamics of escalation, planning and resource allocation, preparedness, training & exercising, ethical and socio-political factors)	• Lack of interest of decision makers because the organizations don't have this "analytical culture"
• Demonstrated and validated it in two essentially different trial scenarios	• Only applicable with an in-house technical staff or with external consultants
• Generally applicable to the developing health care market	• Budgetary restrictions in public institutions.

6   Conclusions

The main exploitable results of PULSE are the decision support and training tools, which, together with the methodology, may improve the preparedness and response capabilities of the health services involved in major emergency situations, mitigating the loss of life and raising the survival rates among mass casualties. The main elements that differentiate PULSE from existing solutions are its modularity, scalability as well as the ability to be rapidly customized for integration with existing systems and adoption of new procedures/standards.

The immediate promising commercial application are:

- **Smart Apps:** the ability by Skytek to integrate the PULSE smart apps into its current REACT system. The proposed REACH project will introduce PULSE to the American Red Cross. A key player within the MEM industry across the USA and beyond.
- **MPORG & LMS:** are stand alone training support systems that can enhance the preparedness of decision makers. These system will now be integrated into Skytek's REACH project for use by the American Red Cross
- Leonardo's commitment to explore the possibility of integration into Leonardo's commercial operations in the area. Leonardo has the size and scale to effectively commercialise a public sector oriented system like Pulse.

The main drivers for PULSE further development and adoption as an operational system are:

- Support offered for the improvement of the health services in both preparedness and response stages of a major medical incident, enabling a more efficient emergency management.
- Potential for operational procedures harmonization across EU and an improved cross border cooperation of the medical services.
- Support for an enhanced management of hospital resources.
- Efficient training tools with real life simulations for better training and an enhanced preparedness of the personnel involved into the management of the major medical emergencies.
- Improved understanding of public acceptance, legal, ethical and social issues in major emergency management.

As shown in this document, the different members of the consortium are interested in the exploitation of the project results from the perspective of their individual background and commercial interest. The strong involvement of end users ensured that the Pulse platform is a system that meets the needs and requirements of a modern European Health System.

In addition, according to the consortium level exploitation strategy proposed, it seems feasible to bring PULSE platform to the market but the exploitation strategy proposal should be completed with the corresponding business plans, which must set the benefit generation strategy to ensure the system sustainability. This is a step forward that should be taken when TRL of the outcomes is increased, at least at level9.

Finally, the consortium is aware of the main strengths of the PULSE results but also of the risk that it faces and its weaknesses. Some of these include the lack of procedural harmonization across EU medical emergency services, need for further developments for customization and integration with existing systems or the difficulty of reaching new funds for the further development and maturity of the PULSE outcomes among others.

7   References and acronyms

7.1 References

[1] PULSE PROJECT, "D4.1 PULSE Decision Support and validation Tool"
[2] PULSE PROJECT, "D4.2 PULSE IAT Tool"
[3] PULSE PROJECT, "D4.3 PULSE Logistic Tool"
[4] PULSE PROJECT, "D4.4 PULSE Surge Capacity generation support tool"
[5] PULSE PROJECT, "D4.5 PULSE Training tools"
[6] PULSE PROJECT, "D4.6 PULSE Post crisis evaluation tool"
[7] PULSE PROJECT, "D4.7 PULSE Event evaluation model for biological events"
[8] PULSE PROJECT, "D3.1 Context Models"
[9] PULSE PROJECT, "D3.2 Scenario Generator"
[10]   PULSE PROJECT, "D5.2 PULSE SOPs"
[11] EUROPEAN COMMISION - HORIZON 2020 – WORK PROGRAMME 2014-2015 General Annexes G. Technology readiness levels (TRL) (https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf)
[12]   PULSE PROJECT,"PULSE's Project Handbook "
[13]   PULSE PROJECT,"D9.1 Dissemination Master Plan"

7.2 Acronyms

ALS: Advanced Life Support

ATLS: Advanced Trauma Life Support

BLSD: Basic Life Support and Defibrillation

CBRNe: Chemical, biological, radiological, nuclear and explosives

CESS: Centre for European Security Strategies Gmbh

DEA: Emergency Department

DPIA: Data protection impact assessment

DSS: Decision Support System

DSVT: Decision Support and Validation tool

ECDC: European Centre for Diseases Control

EHS : European Health Services

EIA: Ethical impact assessment

EMS: Emergency Medical Services

ENSIR: Event Evolution model for Biological Events

EPILS: European Paediatric Intermediate Life Support

EPLS: European Paediatric Life Support

ERC: European Resuscitation Council

EU-MIC: Monitoring and Information Centre

EU: European Union

FINM: LEONARDO-FINMECCANICA Spa (former FINMECCANICA Spa)

FP5(IST): 5th Framework Programme - Information Society Technologies Research

FP7(SEC): 7th Framework Programme – Security Research

GDPR: General Data Protection Regulation

GPS: Global Positioning System

GUI: Graphical User Interface

HEARTS: Health Early Alarm and Telemonitoring System

HSE: HEALTH SERVICE EXECUTIVE

EELPS: **Ethical**, economic, legal, political and societal

EHS: European Health Services

ELSA: Ethical, legal, social impact assessments

ESA: European Space Agency

IAT: Intelligence and Analysis Tool

ICT: Information & Communication Technology

ILS: Intermediate Life Support

INMI: Istituto Nazionale Malattie Infettive

iPV: International procedural viewer

LMS: Learning Management System

LT : Logistic Tool

MEM : Major Emergency Management

MPORG: Multi Player on line role game

NASA: National Aeronautics and Space Administration

NGO: Non – Governmental Organization

NLP: Neuro-linguistic programming

OSDIFE: Osservatorio sulla Sicurezza e la Difesa CBRNe

OST: ONEST SOLUTIONS SRL

P+EIA: Privacy & Ethical Impact Assessment

PCET: Post Crisis Evaluation Tool

QCA: qualitative criteria assessment

REACT : Resource for Emergency Services to Access Command and Control

SCGT: Surge Capacity Generation Support Tool

SICMA: Simulation of Crises management Activities

SIR: Susceptible - Infected - Recovered

SKY: SKYTEK LTD

SME: Small- Medium Enterprise

TRI: TRILATERAL RESEARCH LTD

TT: Training Tool

UCL: Université Catholic de Louvaine

UCSC: UNIVERSITA CATTOLICA DEL SACRO CUORE

UN: United Nations

USA: United Space Alliance

WHO: World Health Organization