



## **Operational Risk: Implementing Open Norms (ORION)**

### **Intellectual Output 5 (IO5) Report August 2021 SMS Norms of Practice**

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## Executive Summary

### Operational Risk: Implementing Open Norms (ORION) Project Introduction

Launched in December 2018 and running until August 2021 the Erasmus+ funded project Operational Risk: Implementing Open Norms (ORION) was a 32 month project that designed, developed, delivered and evaluated a training programme to support and advance the implementation of Safety Management Systems (SMS) in safety critical sectors including emergency services, healthcare, and aviation. The results of the ORION project are free to use and are available on open access through the Erasmus+ Project Results platform. Through the use of these results, ORION aims to enable aviation, healthcare, emergency response and other safety critical sectors realise high and constantly improving levels of safety risk management.

Learning from errors and incidents typically means that people have been exposed to unacceptable risk of harm. Therefore, the proactive and prospective management of risk is essential to supporting a safe working environment for professionals and the people they serve. A Safety Management System (SMS) that is firmly embedded in the daily practice and culture of organisations is key to achieving this. A SMS is built around four pillars: Safety Policy; Risk Management; Safety Assurance; and Safety Promotion. Safety management is conceived as a set of activities and processes, which involves the collaborative action of diverse stakeholders – safety professionals, operational staff, management of operations, planning etc., senior managers and accountable managers. The best SMS exists when the organisation continually looks for, and manages risks and hazards in a transparent way. This helps to ensure effective practices according to the best achievable standards as well as a high and constantly improving level of safety. However, before the ORION project there was a paucity of guidance and a lack of standards to support best practice in the implementation and embedding of SMS to reach a point whereby safety management becomes part of the practice and culture of an organisation. This was the motivation for the ORION project.

The ORION project consortium was made up of five partners across four European countries who brought together a wealth of expertise in safety risk management. ORION was coordinated by Trinity College Dublin with Kungliga Tekniska Hogskolan, Sweden; Kratis Training and Consulting Ltd., Cyprus; Ergonomica, Italy; and Stamina Consulting Ltd., Ireland as partners. In addition, Dublin Fire Brigade, Ireland; the Emergency Ambulance Physicians Association, Turkey; Ospidal San Rafele, Italy; SAS Airlines, Sweden; TUS Airways, Cyprus; and Skylink Services Cyprus formed the group of ORION associate partners who represented the target groups and sectors that the ORION project addressed. The inter-agency collaboration between the ORION partners and associate partners was key to ensuring that the ORION Safety Management Systems implementation training has been designed and developed to meet the needs of emergency services, healthcare, and aviation organisations. The strong and productive collaboration between the ORION partners and associate partners from the target sectors has been key to achieving a number of important project results. These results, which are described below, are free to use by organisation who aim to improve their safety risk management.

### ORION Project Deliverables – Intellectual Outputs

Through this collaborative approach the ORION has delivered the following project results.

### Safety Management Systems Maturity Assessment

The Safety Management Systems (SMS) maturity assessment was the first results of the ORION project. This involved conducting analysis and review of safety risk management practices in the emergency response, healthcare and aviation sectors, and involved close collaboration between the project partners and associate partners. The safety management maturity assessment involved interviews, observations of working practices and reviews of relevant documentation on safety risk management. The willingness of the associate partners to support this research ensured that a comprehensive examination was undertaken. From this several key findings were obtained:

- All associate partners either had an SMS or had elements of safety risk management that could support the development of a SMS within their organisations;
- Each associate partner was highly motivated to improve their safety risk management capabilities in order to realise the benefits of enhanced safety for their members and their service users. The associate partners wished to go beyond SMS compliance and to make sure that safety management was implemented in line with their safety risk management goals;
- The maturity of the SMS varied across each of the associate partners. This finding should be interpreted with the understanding that SMS is a regulated requirement in the aviation sector; as yet, SMS are not mandated for emergency services and healthcare organisations;
- It was evident from the varying levels of SMS implementation that bespoke training would be needed to ensure optimal outcomes and impact from the ORION project.

The results of the Safety Management Systems Maturity Assessment is intended to be used as a guide for those responsible for safety risk management to perform their own assessment of safety management capability for developing a safety improvement strategy.

### ORION SMS Implementation Training

The findings of the SMS maturity assessment contributed directly to the design and development of the ORION implementation training. The ORION SMS implementation training involved a co-creation process among the partners with the inputs of associate partners. This involved collaborative content development, review and revision. This iterative development process delivered five core SMS training modules to introduce SMS and safety risk management concepts, principles and practices. In addition, six implementation modules addressing specific topics for the advancement of SMS were developed. 11 ORION modules were developed in total. The need for the ORION modules was identified through the SMS maturity assessment. The ORION SMS Core and Implementation Training modules are:

1. Introduction to SMS
2. Safety Culture
3. Reporting – Just Culture
4. Risk Management – Hazard Identification
5. Risk Management – Risk Assessment
6. SMS Maturity Assessment
7. Operational Risk and Organisational Hazard

8. Proactive Risk Management
9. SMS Data Analytics
10. Monitoring and Measurement for Safety Assurance
11. Change and Strategy

Modules can be selected for training delivery based on the specific needs of an organisation. The slides for the core SMS on day course are available in English, Swedish, Italian and Greek. Additional specific courses for managers and key personnel are also available in English. The slides for the SMS implementation training (modules 6-10) are available in English. In addition, scripts for modules 6-10 are also available in English, Swedish, Italian and Greek. The training content has also been developed with sufficient flexibility to be used for classroom and/or online delivery.

#### ORION SMS Implementation Training Validation

In parallel with the ORION SMS training delivery, evaluation and validation of the training was undertaken. The results of this revealed a high level of satisfaction among training participants. Very importantly participants saw the relevance and value of implementing and advancing SMS in their organisations. For the aviation associate partners the ORION SMS training was key to helping them meet and advance SMS beyond the requirements of aviation regulations. For the emergency services and healthcare sector regulations were less of a concern, however, they valued the consolidated and integrated approach to safety risk management that the ORION SMS training offered.

The ORION SMS Implementation Training Validation report is intended to be used as a guide by for those responsible for safety risk management to perform their own evaluation and validation of their SMS programme. The findings of an evaluation and validation report can help inform subsequent cycles of SMS implementation through identifying additional safety management capabilities and gaps.

#### ORION Implementation Framework

The ORION Implementation Framework emphasises the transition from full compliance with SMS requirements to effective and transparent SMS performance through an Advanced Risk Management programme. It recognises the considerable organisational commitment and effort required to put in place the essential components on an SMS – the policy and strategy; the people, committees and reporting relationships; the processes for reporting, risk management, compliance, communication and training. These are the focus of the core SMS training. However, it is a further step to make such an SMS function to improve the safety performance of the system as a whole. The Advanced Risk Management components of the ORION training focus on developing this standard of excellence, by making an explicit link between the training and the design and implementation of improvement projects. This is supported by a dedicated software platform (ARK, 2021). The training and the platform address key aspects of Advanced Risk Management: a methodology for analysing the socio-technical dimensions of complex operational risks; the role of data analytics in managing operational system performance; managing the risks involved in improvement and change; and building a strategic capability to manage improvement and change. Thus, the ORION Implementation Framework directly links training to project implementation; in turn this will start to build an evidence base for Advanced Risk Governance.

This implementation framework is currently being trialled in a group of emergency service and healthcare organisations with a focus on infection control in the COVID-19 pandemic.

#### ORION Norms of Practice Manual

The final result of the ORION project is the 'ORION Norms of Practice Manual' user guide (this project deliverable). This guidance manual consolidates the results of the ORION project into a convenient resource that can be used to support ORION training for trainers and trainees. It is intended to be transferable across organisations, regions and industrial and service domains.

#### What's next for ORION and Safety Risk Management?

It is important to demonstrate what is possible in terms of good practice in safety management system (SMS) implementation across a range of industries. ORION will continue to support this through enabling open access to the project results. The results are available for use by public, private and voluntary emergency services and related safety critical organisations. These can be used as resources to build and progressively improve the real functioning of SMS in dealing with the pervasive intractable problems of operational risk.

Ongoing activities with ORION partners has been planned to continue this work and project results are being integrated into training and educational programmes. For example, the Stamina Human Factors and Safety Management Systems programme hosted by Trinity College Dublin will continue to implement ORION with partners and clients. New projects will also be coming online soon that will continue to develop safety risk management capabilities in emergency services.

## Acknowledgements

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## Introduction

This report details the consolidated findings of the Operational Risk: Implementing Open Norms (ORION) project that was conducted through the activities of Intellectual Output 5 of the ORION project. The aim of this report is to provide the reader with a useful guide to implementing a Safety Management System (SMS) and supporting safety risk management within their organisation or setting. The ORION project addressed systemic risk in order to advance safety management in safety critical sectors. ORION undertook this in the aviation, healthcare, and emergency response sectors. However, the findings of the ORION project are intended to be applicable to other contexts, systems and sectors. It is also recommended that wider literature on SMS specific to sectors of interest is considered to support the localisation of findings presented here.

Below a brief definition and description of the Safety Management System (SMS) is provided. Following this an overview of the ORION project and the focus of Intellectual Output 5 (IO5) is presented.

### What is a Safety Management System (SMS)?

The International Civil Aviation Organisation (ICAO) define a Safety Management System (SMS) as, *“a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures,”* (ICAO, SMS Manual 4<sup>th</sup> edition, 2018). The overall aim of a SMS is to proactively and prospectively manage safety in order to minimise risks to system through the removal or mitigation of hazards. A SMS is based on an inclusive philosophy whereby each actor within a defined system actively contributes to safety. This is often achieved through communicating safety and relevant performance related issues through formal reporting systems. As ICAO state, *“safety management effectively implemented can lead to a documented, process-based approach to safety, as well as a better understanding of safety-related interdependencies and relationships,”* (ibid). Therefore, the generation of knowledge about the system safety requires significant amounts of data to be elicited, managed and effectively analysed in order to establish a realistic understanding of the system as close to real time as possible. The resulting knowledge needs to be transformed into actions that uphold or enhance safety of the system for its members and users.

The ICAO SMS Framework is set around four components (also referred to as pillars of SMS).

- Safety policy and objectives:
  - Management commitment and responsibilities;
  - Safety accountabilities;
  - Co-ordination of emergency response planning;
  - SMS documentation.
- Safety risk management
  - Hazard identification;
  - Risk assessment and mitigation.
- Safety assurance:
  - Safety performance monitoring and measurement;
  - Management of change;

- Continuous improvement of the SMS.
- Safety promotion:
  - Training and education;
  - Safety communication.

### The ORION Project Overview

The Operational Risk: Implementing Open Norms (ORION) project has developed and implemented training to foster soft socio-technical skills for fully implementing and embedding a safety management system (SMS) and managing operational risk. ORION focuses on the skills needed to make the transition between fulfilling the formal requirements of a SMS and having a system that is fully embedded in normal operational practice so that it is fully part of the culture of the organisation, ensuring effective practice according the best practicable standards and delivering a high and constantly improving level of safety. This requires the skills and capability to productively address the systemic factors that influence and motivate people to behave in particular ways and to facilitate change. It also requires learning from others' experience.

The ORION project is co-funded by the Erasmus+ Programme of the European Union.

### Objectives

The overall goal of ORION is to improve outcomes in the management of operational risk, across a wide range of risk-critical industries. Knowledge can also be utilized to contribute to a stronger economy and business model in the provision of safety related services across safety critical industries, and to promote a culture of sharing and learning from best practice in implementation among industry partners.

The aims of the ORION project are delivered through five objectives:

1. To design and develop training materials to support and facilitate implementation and embedding of SMS in norms of practice and effective management of risk in the operation.
2. The training can be delivered in short courses in the associate organisations. A common train-the-trainer programme leading to training in the ORION project Associate Partner organisations, each was directly supported by an ORION partner.
3. The training and support aims to result an implementation case study approach. This is intended to build and extend the knowledge base of evidence that links multiple implementation cases studies.
4. A validation programme starting with stakeholder needs and progressively verifying delivery on those needs and validate the project outcomes.
5. Utilising evidence on each of these activities to contribute to the development guidelines for open norms of best practice in the full implementation of SMS.

### Background to the ORION Project

The background to the ORION project are framed around several complementary identified needs:

### *Implementing SMS and Managing Operational Risk*

The Associate Partners of this project are in various stages of implementing SMS and integrating SMS with OHSAS. They need to achieve real value from this organisational effort. Embedding SMS requires building actual norms of behaviour and performance, reporting, implementing improvement.

### *Creating an evidence base*

An empirically grounded evidence base of SMS implementation is lacking. While ORION is based on a wide range of research in certain industries (aviation, maritime, health, emergency services), there is a need to create a more comprehensive evidence base of what works in implementing SMS across a range of industries and regions.

### *Best practice guidelines*

There are not many standards or much guidance as to how to implement and embed SMS. One good example of best practice guidelines comes from the Civil Air Navigation Services Organisation (CANSO) who published a Standard of Excellence in Safety Management Systems (SoE in SMS) and an associated implementation guide to support ANSPs (Air Navigation Service Providers) in their safety management. The CANSO SoE in SMS is compliant with ICAO Annex 19 (ICAO. Annex 19: Safety management. International Civil Aviation Organisation; 2013). This is largely a generic standard that is easily applicable to other industries. Level E of this standard is the highest level of implementation and embedding of safety practices that are shown to be effective. Another example is Transport Canada guidelines for both development and assessment of SMS in aviation. However, while there is a strong logic to these documents it lacks a solid evidence base from actual implementation.

### *Generate Open Norms*

Overall, it is important to demonstrate what is possible in terms of good practice in SMS implementation across a range of industries. This then shows what could and should be normal. Creating open access to this evidence in implementation case studies begins to build open norms of how to progressively improve the real functioning of SMS in dealing with the pervasive intractable problems of operational risk.

### *Intellectual Outputs*

The results of the ORION project are linked directly to the Intellectual Outputs and Multiplier Events that have been delivered through the project. Each of the Intellectual Outputs provide important results that are of value to the industries and sectors who are represented by the Associate Partners in the ORION project. These are described briefly below:

#### *Intellectual Output 1 (IO1) SMS Maturity Assessment*

Intellectual Output 1 provides a report synthesizing research evidence and best practice guidelines, together with an analysis of the current maturity level of Safety Management Systems (SMS) in the Associate Partner organisations. This analysis will support the development of SMS Implementation Training.

#### Intellectual Output 2 (IO2) SMS Implementation Training

Intellectual Output 2 (IOS) provides an overall training design for train the trainers within the partnership as well as training SMS facilitators within the Associate Partners (including design of the facilitation and training to be offered by the facilitators in their organisations). This training includes developing an implementation case study approach. An initial training design and development activity occurred ahead of training events delivered to each of the Associate Partners that supported the full SMS implementation activity.

#### Intellectual Output 3 (IO3) SMS Implementation Validation

The purpose of Intellectual Output 3 (IO3) is to demonstrate how to undertake validation to provide confidence that the concept being developed and implemented meets the stated objectives in practice. Key activities of the validation tasks in ORION are to:

- Ensure the SMS needs are fulfilled.
- Iteratively verify and validate components and activities through stages of concept, design, implementation and operations during project.
- Feedback to various providers of progression according to requirements along the development stages.

#### Intellectual Output 4 (IO4) SMS Implementation Framework

In Intellectual Output 4 (IO4) best practice guidelines are consolidated the initial evidence base, the training designed and delivered, and evaluated and validated using a case-based approach. This draws on the lessons learned about implementation to inform guidelines for best practice in implementation.

#### Intellectual Output 5 (IO5) SMS Norms of Practice Manual

Intellectual Output 5 (IO5) offers guidance on SMS Norms of Practice and consolidates lessons representing the core aspects of each of the previous outputs. This is designed to maximise transferability and impact by presenting in appropriate media the essential content of the ORION programme. This is innovative in providing concise evidence-based standards of good practice in SMS implementation, that are carefully designed to be easily transferable between organisations, across industrial and service domains, and spanning different regions. The SMS Norms of Practice provides a material report for the that can be used to support ORION SMS activities.

## ORION Intellectual Output 5 Norms of Practice Manual

This report, ORION Intellectual Output 5, consolidates the learning from the ORION project and outlines a roadmap towards a comprehensive approach to training for safety and reduction of risk. This is intended to be applicable across a range of industries by providing a Safety Management Systems (SMS) Norms of Practice guide and the materials to implement that journey. A core concept is the initial implementation and evolving maturity of the safety management system. Operational systems are dynamic and complex and the management of safety has to develop into a system that is fully embedded in normal operational practice so that it is fully part of the culture of the organisation, ensuring effective practice according to the best practicable standards and delivering a high and constantly improving level of safety. Yet most organisations find it enormously challenging to make the transition from having a management system 'on paper' to living it on a day-to-day basis. It requires the skills and capability to productively address the systemic factors that influence and motivate people to behave in particular ways and to facilitate change.

Training in the principles and practices of SMS is a necessary first step to establishing a safety management system that is compliant with regulatory requirements. Everyone in the organisation needs to know their responsibilities and how they contribute to the safety system of the organisation. This knowledge and understanding is a precondition for establishing the policies and procedures, roles and responsibilities, committees, co-ordination and information processes that comprise the elements of a Safety Management System.

This is the starting point for ORION training – the provision of a suite of SMS training courses for all personnel, for personnel with key responsibilities for safety and for managers.

However, having those elements in place does not guarantee that the SMS will work as a system – ensuring the safe performance of the operational system, delivering effective improvement when required and providing an informed basis for developing a proactive safety strategy. The evidence shows that risks in complex operations are difficult to understand, improvement and change is uncertain and prone to failure. Thus stasis in the face of longstanding evidence of the need to change is typical rather than exceptional.

To address these challenges ORION has developed an innovative training course in Advanced Risk Management addressing the complexity of real time operations through understanding basic principles of socio-technical systems, operations management, and leveraging data to understand operational risk. At the core of Advanced Risk Management is the ORION implementation framework which links training to doing through the development of practical projects in safety and risk. It is facilitated in this by the ARK Risk Management Platform which links analysis to data along an implementation pathway.

ORION also provides a validation and evaluation framework to support effective training outcomes. Evaluation focuses on the quality of the training delivery itself. Validation takes a deeper and longer perspective concerning the impact of the training on the objectives and goals set. As the SMS evolves in maturity, those goals and the required impact focus increasingly on the ability of the SMS to influence performance, change and strategy of the system as a whole, rather than the functioning of the SMS in itself.

## Needs and Gaps – SMS maturity assessment

### The regulatory framework for SMS

The International Civil Aviation Organisation (ICAO) defines a Safety Management System (SMS) as, *“a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures,”* (ICAO 2018). The overall aim of a SMS is to proactively and prospectively manage safety in order to minimise risks to system through the removal or mitigation of hazards. A SMS is based on an inclusive philosophy whereby each actor within a defined system actively contributes to safety. This is often achieved through communicating safety and relevant performance related issues through formal reporting systems. As ICAO state, *“safety management effectively implemented can lead to a documented, process-based approach to safety, as well as a better understanding of safety-related interdependencies and relationships,”* (ICAO SMS implementation website). Therefore, the generation of knowledge about the system safety requires significant amounts of data to be elicited, managed and effectively analysed in order to establish a realistic understanding of the system as close to real time as possible. The resulting knowledge needs to be transformed into actions that uphold or enhance safety of the system for its members and users.

Two aspects stand out in this new approach to managing safety. First the integration of the management of safety into the overall management system of the organization; and second that this should be a performance-based regulation, capable of demonstrating its implementation and effectiveness in terms of measurable operational outcomes, related to safety (Ulfvengren, 2009).

### Approaching SMS Maturity Assessment

The lack of standards and guidance as to how to actually implement and embed SMS has been stated in the introduction to this report. One good example of best practice guidelines comes from the Civil Air Navigation Services Organisation (CANSO) who published a Standard of Excellence in Safety Management Systems (SoE in SMS) and an associated implementation guide to support ANSPs (Air Navigation Service Providers) in their safety management (CANSO. Standard of Excellence in Safety Management Systems. Civil Air Navigation Services Organisation; 2015. CANSO. Safety Management System Implementation Guide. Civil Air Navigation Services Organisation; 2015.). This is largely a generic standard that is easily applicable to other industries. Level E of this standard is the highest level of implementation and embedding of safety practices that are shown to be effective. However, while there is a strong logic to this document it lacks a solid evidence base from actual implementation.

Transport Canada’s guidelines emphasise that safety needs to be “woven into the fabric of an organization. It becomes part of the culture; the way people do their jobs”, “the system must be integrated into «the way things are done» throughout the establishment” and “every employee in every department contributes to health and safety” (Transport Canada, 2008). TC describes five generic features to characterize a SMS:

1. A comprehensive systematic approach to the management of aviation safety within an organization, including the interfaces between the company and its suppliers, sub-contractors and business partners.
2. A principal focus on the hazards of the business and their effects upon those activities critical to flight safety.
3. The full integration of safety considerations into the business, via the application of management controls to all aspects of the business processes critical to safety.
4. The use of active monitoring and audit processes to validate that the necessary controls identified through the hazard management process are in place and to ensure continuing active commitment to safety.
5. The use of Quality Assurance principles, including improvement and feedback mechanisms.

## Assessing SMS Requirements

The main issues and challenges identified with fully implementing and SMS and mature to excellence were identified in the components of Safety risk management (Hazard Identification and Risk Assessment) and Safety Assurance (Safety Performance Monitoring and Measurement, Management of change, and Continuous Improvement).

Collating the SMS implementation needs and requirements of the different associate partners has identified both commonalities and differences between industries, operations and how operations are organized. From the cases we found differences among the partners in overall maturity, size of organization and different operations and risk due to context. Some partners have worked with SMS for many years and some have just started to systematically identify what is an SMS and what is required for compliance

Our findings show that the standard SMS assessment template did not capture the complexity of operational areas and their various contexts or how they were organised. It was also found that SMS components may be compliant but the assessment gives little evidence of how well they function and contribute to the overall functioning of the whole SMS. We also found that much safety work and activities are on-going but may not be captured in the SMS assessment, one reason being that employees do not identify every day on-going operations management as safety activities per se. An SMS assessment that results in excellence requires the implemented SMS to validate all functions of an SMS.

### ORION training concept - aimed for SMS excellence

Traditional SMS training provides the basics of an SMS and each of the components and elements. This training is effective for implementing SMS for regulatory compliance, given that it is a sufficient requirement to have evidence that all components are implemented in the organisation.

But as part of a performance-based regulation in time regulators will expect that a compliant SMS will have improved its functionality and become “fully embedded”. This would be demonstrated by climbing on the maturity scale and the goal is to have an SMS in which all these components and pillars are working well together as a whole towards the level of excellence.



An important finding in our research is that organisations that are compliant and have high ambitions, still face challenges in further implementing their SMS and mature towards excellence, even after years of compliance. There are challenges for organisations to actually improve from a level of compliance to a level of excellence.

Needs were identified from the SMS maturity assessment and gap analyses, and through findings indicating weaknesses in current organizational capabilities. Combining these needs resulted in requirements that may be verified with an ORION training concept. This training concept addresses challenges to maturity by developing training that links the four “silos” of the SMS pillars (see figure 1). Between the pillars of Safety Risk Management (on the one hand) and Safety Assurance (on the other) is a lot of work of implementation, mitigating risk in operations, improving the system through targeted projects, achieving strategic safety objectives activities that is core and should effectively be embedded in every-day practice. It is this work that can, in turn, make Safety Policy and Objectives more proactive, flexibly engaged with new and emerging issues and actively monitoring improvement. Joined up governance – different departments working together – enables the gathering of evidence that sustains strategy. This dynamic activity makes it possible to provide a new level of tailored and focused support for operational performance, embedding good practice in everyday operations through Safety Promotion. These links are underspecified in the SMS regulation – but they are essential to a strategy for sustaining the SMS as a functioning system that is aware of the complex risks it faces, able to adjust to mitigate those risks and thus able to purposely achieve its strategic goals to improve quality and safety, and, at the same time, sustaining a positive safety culture.

To visualize our consolidated framework for training for SMS excellence the overarching functionality of the safety risk system perspective is presented as arches bridging the four SMS pillars.

- Complex risk – advanced risk knowledge.
- Fully embedded SMS – implementation
- Joined-up governance – evidence sustains strategy
- Sustain safety culture – focused support for performance

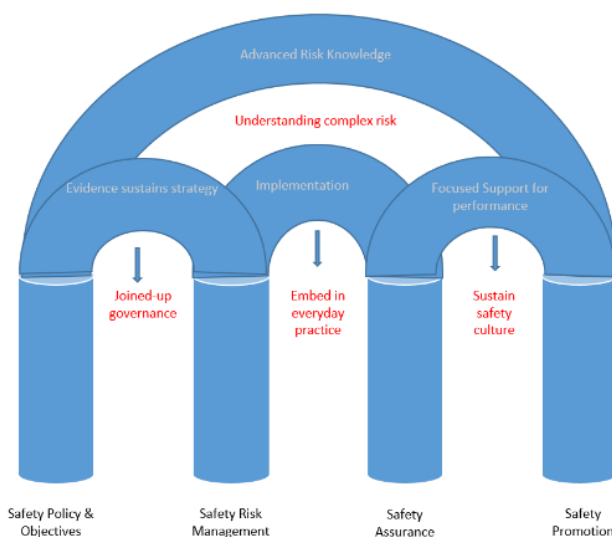


Figure 1. ORION training concept for advanced risk management.



## Conclusions and requirements

There is an 'SMS maturity journey': Compliance -> Performance -> Excellence.

Achieving compliance requires commitment of considerable effort and resources to put the infrastructure, processes and information systems of SMS in place. This increasingly begs questions about performance of the SMS - is it delivering the outcomes that are planned and expected. This implies a concept of SMS excellence - how to implement that? From this it follows that there is a requirement for dual training approach:

**Core SMS training** for the introduction of SMS and periodic refreshment of awareness and participation in an active organisational system. Everyone in the organisation needs to have some understanding of what an SMS is and how it should work; those with specialised roles need more in-depth understanding; and managers require a level of understanding commensurate with their role in implementing safety management in everyday practice.

**Advanced management** training in safety and risk. In ORION we have based advanced SMS training on the following three emergent capabilities:

- New large data streams to support analysis of input, activity and output
- Qualitative analytic methods on socio-technical dimensions (in normal operations, change and crises) complement data/information in implementation case studies
- Big data analysis plus model-based reasoning, identifying generic socio-technical system characteristics

In addition the training concept should include norms and best practices for human-centred management known to foster participation in development and change. This concept is developed in the ORION implementation framework (IO4), including a concept for a new productive governance that builds evidence, enables learning and guides the work.

## ORION Training Programme

The ORION Training Programme has been developed based on the findings of the SMS Maturity Assessment (described above and in ORION IO1). In addition, the expertise of the ORION consortium and inputs from ORION associate partners led to a co-creation and co-design approach to SMS training that was developed to address the needs of the target sectors of the project. This involved collaborative content development process included iterative review and revision. Using the evidence base created through the Maturity Assessment, and the training gaps highlighted by project partners and associate partners the need for both 'Core SMS' and 'Implementation SMS' training was identified in the ORION project. These are briefly described in the sections below.

ORION SMS Training modules can be selected for training delivery based on the specific needs of an organisation. The slides for the core SMS on day course are available in English, Swedish, Italian and Greek. Additional specific courses for managers and key personnel are also available in English. The slides for the SMS implementation training (modules 6-10) are available in English. In addition, scripts for modules 6-10 are also available in English, Swedish, Italian and Greek. The training content has also been developed with sufficient flexibility to be used for classroom and/or online delivery.

### Core SMS Training

Core SMS training incorporates initial and advancing SMS modules that are intended to create the awareness of the benefits of a SMS within an organisation, and to help an organisation to develop the roadmap for creating a functioning SMS. The Core SMS modules can be developed to meet the needs of different personnel with differing responsibilities within an organisation. Within ORION three levels of Core SMS Training were developed:

#### Core SMS Training for All Personnel

This was designed as a one-day course intended to be delivered to all the personnel of an organisation. The objectives and modules available for this training course are outlined below. A more comprehensive description of these as well as the training materials and lesson plans are available in ORION Intellectual Output 2.

#### **Objectives:**

- What is SMS
- Importance and benefits of SMS
- Analysis of the 4 SMS Components
- Hazard Identification and Risk Assessment
- Reporting procedures and responsibilities
- Appreciation of the many dimensions of Safety Culture

#### **Modules**

Module 1: Introduction to SMS

Module 2: Safety Culture - Reporting

Module 3: Reporting – Just Culture

Module 4: Risk Management – Hazard Identification

Module 5: Risk Management – Risk Assessment

### Core SMS for Key Personnel

This was designed as a five-day course intended to be delivered to key personnel with responsibility for SMS within an organisation (e.g. line managers, safety and quality personnel, and safety committee members). The objectives and modules available for this training course are outlined below. A more comprehensive description of these as well as the training materials and lesson plans are available in ORION Intellectual Output 2.

#### **Objectives**

- Appreciate the importance of SMS
- Contribute to the effectiveness of hazard identification
- Define the basic SMS components
- Appreciate the importance of Safety Culture
- Appreciate the importance of Risk Management
- Perform data driven Risk Management
- Use RM Excel tool
- Identify Implementation Process
- Perform a Gap Analysis
- Produce recommendations

#### **Modules:**

Introduction

Module 1: Introduction to SMS

Module 2: Safety Culture

Module 3: Key Safety Personnel

Module 4: Safety Assurance

Module 5: Reporting – Just Culture

Module 6: Introduction to RM

Module 7: RM Process - Risk Assessment

Module 8: Practical Risk Management

Module 9: Practical Risk Management – present findings

Module 10: SMS Implementation

### Core SMS for Managers

This was designed as a two-day course intended to be delivered to the managers of an organisation who will be ultimately responsible and accountable for safety risk management (e.g. safety and quality executives, senior managers, etc.). The objectives and modules available for this training course are outlined below. A more comprehensive description of these as well as the training materials and lesson plans are available in ORION Intellectual Output 2.

#### **Objectives:**

- What is SMS
- Importance and benefits of SMS
- Analysis of the 4 SMS Components
- Hazard Identification and Risk Assessment
- Reporting procedures and responsibilities
- Appreciation of the many dimensions of Safety Culture

## **Modules:**

Introduction

Module 1 : Introduction to SMS

Module 2: Safety Culture

Module 3 – Reporting – Just Culture

Module 4: RM – Hazard Identification

Module 5: RM - Risk Assessment

Module 6 – Key People in SMS

Module 7 - Safety Assurance

## Implementation SMS Training

Implementation SMS training involves training that addresses advanced risk management within an organisation. The ORION Implementation SMS Advanced Risk Management training aims to describe and discuss the concepts of Advanced Risk Management, including the achievements and limitations safety management systems; socio-technical approaches to operational systems, operations management and the management of change; the assessment of risk in operations and in the processes of change; the use of data analytics in proactively assessing risk; the strategic management of risk and evidence-based governance.

- To apply - these interpret these concepts in relation to their own organization or other organisations with which they are familiar; and to identify strengths and weaknesses and opportunities for improvement both at operational level and in management systems and processes.
- To analyse – to use the Cube for socio-technical analysis of a particular situation or circumstance
- To evaluate – to use the CMO (Context, mechanism, Outcome), Risk assessment, Risk in Change assessment to assess the risk
- To create – to initiate a new project focusing on risk and/or change using the ARK platform

The ORION Implementation SMS Advanced Risk Management training course is designed for delivery in an on-line distance education format, with a recorded presentation and interactive workshop / tutorial sessions with group exercises. It is linked to the ARK Risk Management software platform which supports the development of an individual risk and safety project by each student. Development of the projects is supported by the interactive workshop sessions. For each module, trainers are encouraged to read the script of the presenter delivering the training to understand the material that is delivered.

The target audience primarily concerns safety and risk managers and those with managerial responsibility for implementing improvement and change in any industry or service. A second target are senior managers responsible for strategic decision making and the strategic risk profile of the organization. A third target are those with regulatory responsibility for safety, risk or quality of service.

An overview of the modules, subject areas and exercises are presented below. A more comprehensive description of these as well as the training materials and lesson plans are available in ORION Intellectual Output 2.

Module	Subjects to be covered	Exercises
Module 0: Safety Management System Maturity Assessment	SMS assessment and gap analysis. Assessment of needs for further training or implementation of an SMS. Overview of ORION Advanced risk Management training	Recorded presentation Live tutorial SMS assessment conducted tailored to home organisation
Module 1: Operational Risk & Organisational Hazard	Organisational capabilities to reduce operational risk. Human systems & sociotechnical principles. Critical sociotechnical mechanisms in complex dynamic operational contexts Systems Engineering principles applied to sociotechnical systems Training & organisational capabilities to reduce operational risk	Recorded presentation Live tutorial  Reflection exercise of own organisations current operations and management  Further reading
Module 2: Proactive Risk Management	Complexity in operational systems Fostering an Obligation to Act The Cube Socio-technical analysis Relationship between risk & value Moving from problem to solution	Recorded presentation Access to ARK platform Live tutorial session Students initiate own project. Further reading
Module 3: SMS Data Analytics	Organisational role of data analytics Data integration Data and risk Standard process for data mining Organisational skills for data analytics	Recorded presentation Live tutorial
Module 4: Monitoring & Measurement for Safety Assurance	Safety performance indicators Leading & lagging performance measures Monitoring and measurement in risk management & system improvement.	Recorded presentation Live tutorial Develop indicators for on-going projects where applicable
Module 5: Organisational Change and Strategy	Challenges in managing change Managing the risk in change Linking risk and value Stages towards Advanced Risk Management Benchmarking system change.	Recorded presentation Access to ARK platform Live tutorial session Students develop project. Further reading

## ORION SMS Training Evaluation and Validation

The purpose of evaluation and validation is to provide confidence that the ORION training programme meets the expectations and training needs of target groups. As described above ORION developed a Core SMS and Advanced SMS programme (see also ORION IO2). The training was based needs identified through the evidence elicited by the SMS Maturity Assessment (above and ORION IO1). The work described here provides a summary of how well the ORION project has met these training need following the initial delivery of the ORION programme. Therefore, the evaluation and validation summary presented here provides an additional evidence base of ORION that can be used to inform subsequent training and implementation support requirements. This is described in more detail in ORION Intellectual Output 3 (IO3).

### ORON SMS Training Evaluation

The ORION SMS Training Evaluation rated the satisfaction of trainees across three dimensions. A short training evaluation was used for this purpose. This is shown below.

#### ***Trainee Reaction Template***

**Course / Training Name:**

**Trainer:**

**Date:**

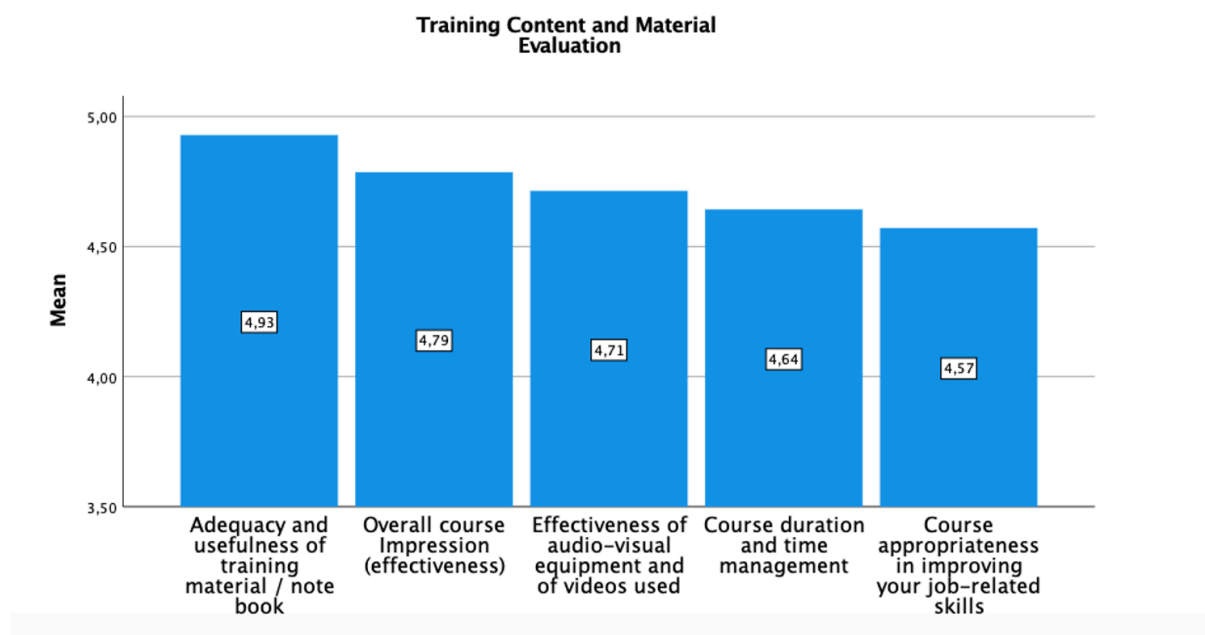
Please indicate with a V or X or **V** your evaluation for each of the following criteria:

A/A	Training Assessment Indicators (Criteria)	Rating (5=max / 1=min)				
		5	4	3	2	1
<b>Training Content and Material</b>						
1.	Overall course Impression (effectiveness)					
2.	Course duration and time management					
3.	Adequacy and usefulness of training material / note book					
4.	Effectiveness of audio-visual equipment and of videos used					
5.	Course appropriateness in improving your job-related skills					
6.	Meeting of course objectives					
<b>Trainer</b>						
7.	Competency of Instructor (to stimulate learning)					
8.	Instructor's communication and course delivery skills					
9.	Facilitation / Interaction techniques used					

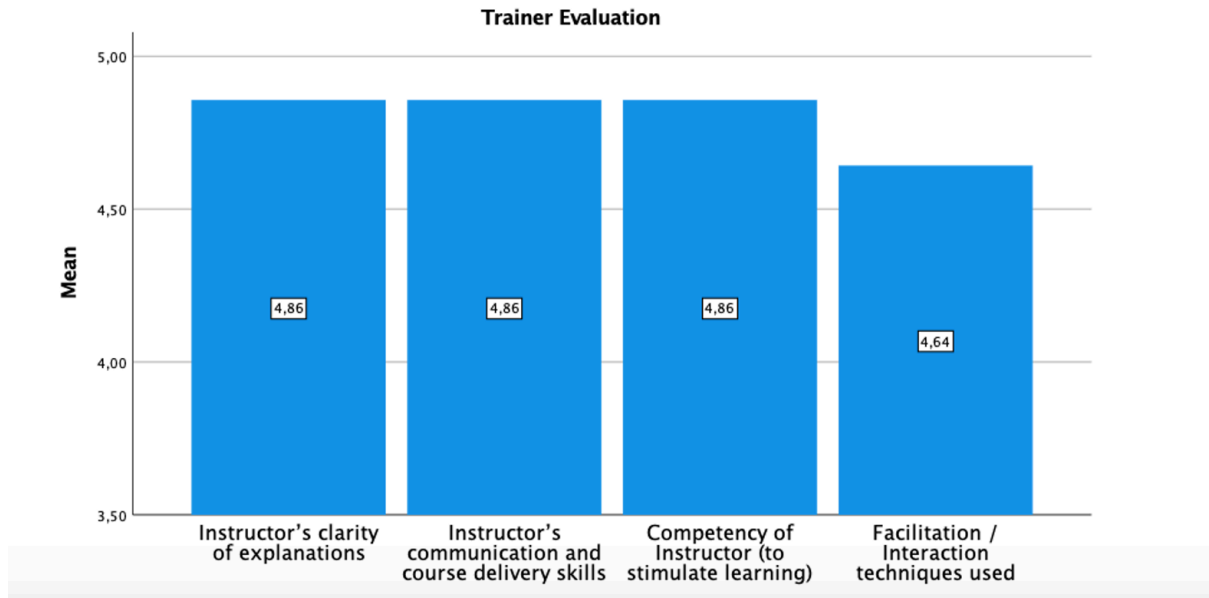
10.	Mannerism / Attitude / Approach by Trainer					
<b>Administration And Venue</b>						
11.	Administration support (communication, joining instructions, etc)					
12.	Training room Suitability (temperature, level of noise, lighting)					
13.	Snacks and Beverages for Breaks/Lunch Provided					

### ORION Training Evaluation Results

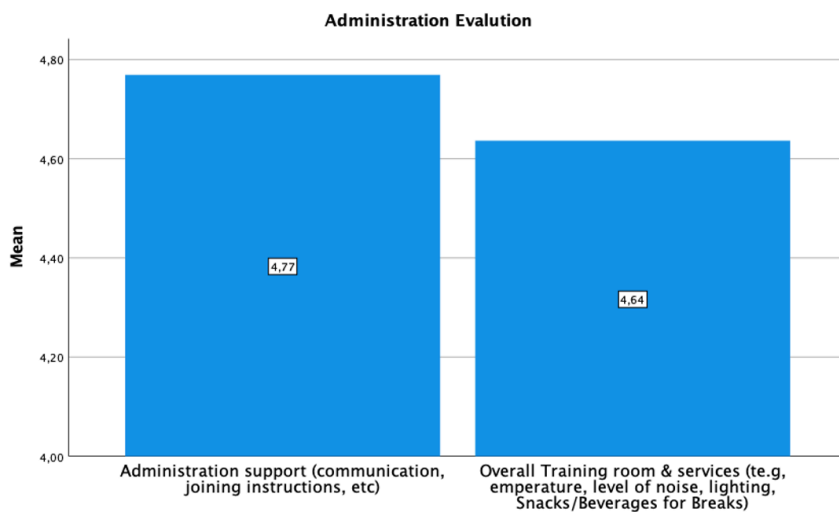
The results of the ORION training content and material was rated very positively with results of higher than 4.5 points for all measures. In particular adequacy and usefulness of all training material was highly perceived as very positive. The table below illustrates these findings (see also ORION IO3).



Similar to the evaluation results for the ORION training content and material, the trainees' evaluation of trainers proficiency was clearly positive. Trainers were on average well suited for the ORION purpose and all values were above 4 points on the rating scale as well.



Although much of the ORION training was delivered online, the training administration and venue elements were favourably well received and rated.



The value of evaluation results like these are important to the learners experiences, which tend to correlate well to their learning outcomes. It is important to capture trainee reactions to these issues in order to ensure that the trainee and trainer potential is optimised and best value is also realised by organisations who send personnel for training.



## ORION SMS Training Validation

The ORION SMS Training Validation took the form of a prospective impact measure that was developed from the SMS Maturity Assessment (Chapter 2 above and Intellectual Output 2). The initial impact assessment yielded a 32 item list. This is presented below.

<b>Safety Policy</b>	<ol style="list-style-type: none"><li>1. ORION course can increase management safety awareness</li><li>2. ORION course can increase Management commitment to safety</li><li>3. ORION course can increase management's understanding of the importance of Just culture</li><li>4. ORION course can increase Just Culture practices</li><li>5. ORION course can increase awareness on SMS importance of everyone's role in safety processes</li><li>6. ORION course can increase knowledge on importance of data evidence to support safety practices/policies</li><li>7. ORION course can increase competence to safety data management and data projects</li><li>8. ORION course can increase capacity to monitor SMS improvement processes</li><li>9. ORION course can improve knowledge on the importance to integrate safety data with other operational/business data to drive better decision making</li></ol>
<b>Safety Risk Management</b>	<ol style="list-style-type: none"><li>10. ORION course can improve Reporting Culture</li><li>11. ORION course can improve the use of a more transparent process for information management</li><li>12. ORION course can increase employee hazard awareness and promote reporting</li><li>13. ORION course can improve awareness on importance of transparent safety information management</li><li>14. ORION course can improve awareness on the criticality of integrating data and databases for safety risk management</li><li>15. ORION course can raise awareness in relation to Human Factors Hazards</li><li>16. ORION course can improve understanding of these issues as variants of system performance</li><li>17. ORION course can increase awareness on the actual processes used for Risk Assessments</li></ol>

	<p>18. ORION course can favour the use of more safety controls to minimise the risks</p> <p>19. ORION course can augment Focus from partial/isolated risk assessments into a more systemic approach</p> <p>20. ORION course can increase the awareness to aggregate and analyse different types of data for more systemic understanding: safety data, normal operational data, implementation projects, cost of safety disruption, etc.</p>
<p><b>Safety Assurance</b></p>	<p>21. ORION course can increase awareness on the effective utilization of SPIs and SPTs</p> <p>22. ORION course can increase awareness of better management of change</p> <p>23. ORION course can increase Integrated risk management to better support strategic priorities</p> <p>24. ORION course can increase more awareness to monitoring change into normal management activity</p> <p>25. ORION course can increase accountability for implementation of risk change initiatives</p> <p>26. ORION course can increase capacity to track SMS project progress</p>
<p><b>Safety Promotion</b></p>	<p>27. ORION course can increase interest to beyond compliance in relation to SMS Training Needs</p> <p>28. ORION course can increase knowledge on communication needs to keep employees informed on safety issues</p> <p>29. ORION course can enhance across operational, implementation of SMS projects</p> <p>30. ORION course can favour more safety information flows across the organization</p> <p>31. ORION course can favour feedback exchange about impact of safety solutions or information adequately</p> <p>32. ORION course can improve wider participation to formal/informal safety discussions in the</p>

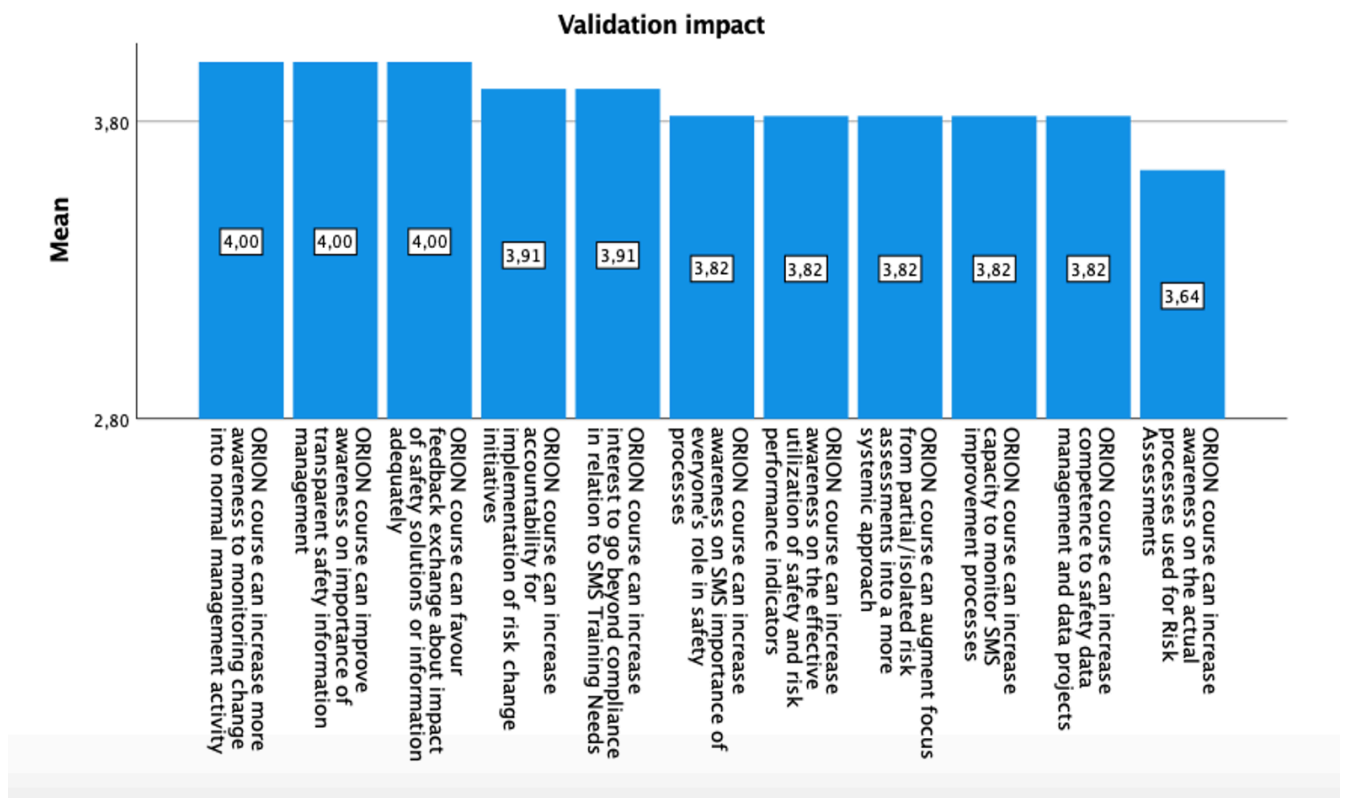
The list of 32 items was reduced through review by ORION SMS experts to a n 11 item questionnaire, which was used in the validation of the ORION training during the project. The number of items were selected to ensure sufficient coverage of topics of interest during

the timeframe of the project. It was also important to use a number of items that would help ensure that all or most trainees would complete the questionnaire. The reduced validation survey that was used in ORION (see ORION IO3) is below.

		Agree	Slightly agree	Slightly disagree	Disagree
<b>Safety Policy</b>					
1.	ORION course can increase awareness on SMS importance of everyone's role in safety processes*				
2.	ORION course can increase competence to safety data management and data projects*				
3.	ORION course can increase capacity to monitor SMS improvement processes*				
<b>Safety Risk Management</b>					
4.	ORION course can improve awareness on importance of transparent safety information management*				
5.	ORION course can increase awareness on the actual processes used for Risk Assessments*				
6.	ORION course can augment focus from partial/isolated risk assessments into a more systemic approach				
<b>Safety Assurance</b>					
7.	ORION course can increase awareness on the effective utilization of safety and risk performance indicators				
8.	ORION course can increase more awareness to monitoring change into normal management activity				
9.	ORION course can increase accountability for implementation of risk change initiatives				
<b>Safety Promotion</b>					
10.	ORION course can increase interest to go beyond compliance in relation to SMS Training Needs				
11.	ORION course can favour feedback exchange about impact of safety solutions or information adequately				

#### ORION Training Validation Questionnaire Results

Targeting the Validation Template, some descriptive statistical analyses were carried out on the available 14 samples providing trends and expectations (average values) for each single question of the total 11 items gauging the expected ORION impact on trainees' or trainers working activities and contexts. This is shown in Figure 9 for Trainees and Fig 10 for Trainers respectively. In fact, all 11 scores were rated above the mid-point of 2.5 suggesting a positive overall trend in terms of the expected impact of ORION SMS training into the trainees' activities on SMS key factors.



The results presented here are clearly positive. They indicate a strong perception of expected impact of ORION SMS training. The results of the trainers' were similarly positive. Although they are not included here, they are presented in ORION Intellectual Output 3.

#### ORION Advanced Risk Management Validation and Impact assessment

In addition to the quantitative validation results presented above, a qualitative account of the ORION Advanced Risk Management was established through feedback from trainees through discussions with the ORION partners. This is presented below.

Overall, the Advanced Risk Management training objectives were achieved to some extent. Throughout the course of the trial, the organisations were able to complete the ORION training and achieve a higher level of understanding of Advanced Risk Management, and subsequently apply the concepts in the context of their own organisation. Participants then initiated a risk project within the ARK platform and subsequently used the platform to analyse and evaluate the problem and solution states for the project.

The chief drawbacks for the organisations concerned the state of development of the ARK platform, which at the time did not contain worked out reporting formats and so lacked clear outputs from each stage. These developments are currently underway and will enable moving to the next steps of implementing solutions. This will be supported by further implementation of ORION training.

Performing a full STSA of risk and an associated corrective project using the CUBE methodology is time consuming. This was in part due to unfamiliarity with the CUBE

methodology; but it also reflected the deeper and richer analysis of risk that the CUBE invited - for example participants reported using the CUBE brought in considerations of culture, communications and sense-making that were not often considered before within the organisations. The process also encouraged wider participation in cross-functional discussion of tacit knowledge associated with specific roles within the organisations that participants reported had never been collected into one place before.

Despite the relatively high levels of experience amongst participants, however, both formal and informal feedback indicated that the training was viewed as highly advanced and somewhat complex—in some cases, it was viewed as more knowledge than necessary to complete an ARK project. Thus, while the ORION training objectives were achieved, there is more work to be done in terms of relating the conceptual aspects of the training to on-the-ground practice within each organisation.

These initial results are encouraging in terms of the active engagement of participants using the ARK Platform to address the complexity of the operational system. The next stages set out a challenging agenda. Moving from analysing problems and devising solutions to implementing those solutions and verifying the outcome will test the participating organisations: risks change over time and therefore priorities for implementation may change; wider participation of operational staff in the implementation phase will challenge the organisations and test the efficacy of the risk in change concept; further training will be needed.

#### ORION Training Evaluation and Validation Conclusions

The ORION Training Evaluation and Validation results and finding presented here show strong positive feedback on the training and potential of ORION. The qualitative findings discussed offer an additional insight into continuous development issues that need to be addressed for SMS in general. The results themselves were useful to the ORION project and illustrate to the reader the potential of the ORION SMS approach. However, more importantly the results and finding presented above offer an insight into how training can be evaluated and validated. This is the principal intention of this chapter. A more detailed description of evaluation and validation is available in ORION Intellectual Output 3.

## Implementation Framework

### Introduction

The ORION Implementation Framework (IO5) provides a practical solution to bridge the gap between a fully compliant SMS and an SMS that fully supports a proactive strategy of managing performance and system improvement. ORION has initiated a developmental process that will continue well beyond the project. The development of the Implementation Framework is described in terms of the basic concept, the needs it addresses, the development of the training, the 'infrastructure' - the ARK software platform that supports project implementation, the implementation and evaluation of this, sustaining this process beyond the project and impact in the short and medium term.

### Concept

The ORION Implementation framework establishes a link between learning and doing; training should lead to implementation case studies to develop and enhance effective safety management. At an organisational level, the competence and knowledge of staff in their different roles should make it possible to implement effective programmes to manage risk, safety and system improvement. Information about these interventions and their impact is gathered as organisational knowledge. Over time, this knowledge accumulates and much can be shared across a Community of Practice (CoP). This system knowledge forms the basis of a new best practice; it further enhances the competence of staff together with the organisation's capability to improve more effectively, reliably and with much greater strategic impact.

### Needs

The ORION Implementation framework seeks to fill important gaps in risk and safety management: compliance with regulatory requirements does not ensure being able to manage system performance in a proactive way; as improvement in quality and safety is prone to failure, the system does not significantly change over time. An effective solution to these persistent endemic problems must exert leverage on critical transformational mechanisms. A set of needs were identified which demonstrate that the solution to the problems of safety management and change implementation is not simple. They place the development of information and transformation of system knowledge at the core of the solution. Developing and applying this knowledge requires new specialised competencies. Learning at individual and organisational levels have to go together.

The Mindful Governance Model put forward some basic principles including the Obligation to Act concept: applying this concept clearly indicates that even an experienced organisation has difficulty in identifying the important risks in complex operations, cannot easily engage in generating effective solutions, and experiences a lack of viable and verifiable pathways for implementing change.

### Development

The ORION Advanced Risk Management training course expounds the concept of Mindful Governance of Operational Risk and supports its implementation through practical project work using the ARK platform. Within an operations management framework, the course aims to build the capability to analyse the risk in complex operations and devise solutions,

using and analysing diverse sets of data, managing the risk in implementing those solutions, and building a strategic capability to manage risk at system level.

### Infrastructure

The Advanced Risk Management programme is supported by the ARK platform. This has been developed as a knowledge-rich software system for managing risk and change. The methodology starts with needs or problem formulation, then supports development of a solution, integrates solutions through planning and preparation, implements the solution in operations (work system) and validates the actual outcome. The ARK Platform is used to build and maintain a unified knowledge graph of risks and projects. This will *create a new, unified risk evidence base* unknown in existing, highly siloed safety systems that emphasise manual risk analysis. When these processes are in place over many projects it will be possible to conduct semi-automated multi-project analysis and distillation of best practice from shareable, privacy-aware knowledge bases based on Linked Data.

### Implementation

The ORION training and ARK platform were deployed in a set of case studies on infection prevention and control (IPC) in the context of COVID-19; These were conducted in a hospital, a clinical unit and an ambulance service, under the auspices of the ARK-Virus project, with training and training evaluation supported by the ORION project. The activity so far has focused on the analysis of the problem and identification of solutions. The main advance has been in developing a fuller and richer understanding of risk and engagement of different points of view. The trials have not yet moved to the planning and implementation phases of the projects. There are good prospects for evidence development and CoP developing best practice. The initial results are encouraging in terms of the active engagement of participants using the ARK Platform to address the complexity of the operational system.

The ARK platform is currently in the first phase of operational trials of its prototype, supported by ORION training. The platform is progressively meeting the identified needs. Trial evaluation shows that the training and platform combination are effective in engaging users in developing rich and relevant projects. The trial also identifies issues for development. Thus, the solution is not complete but is in line with users' needs.

### Sustainability

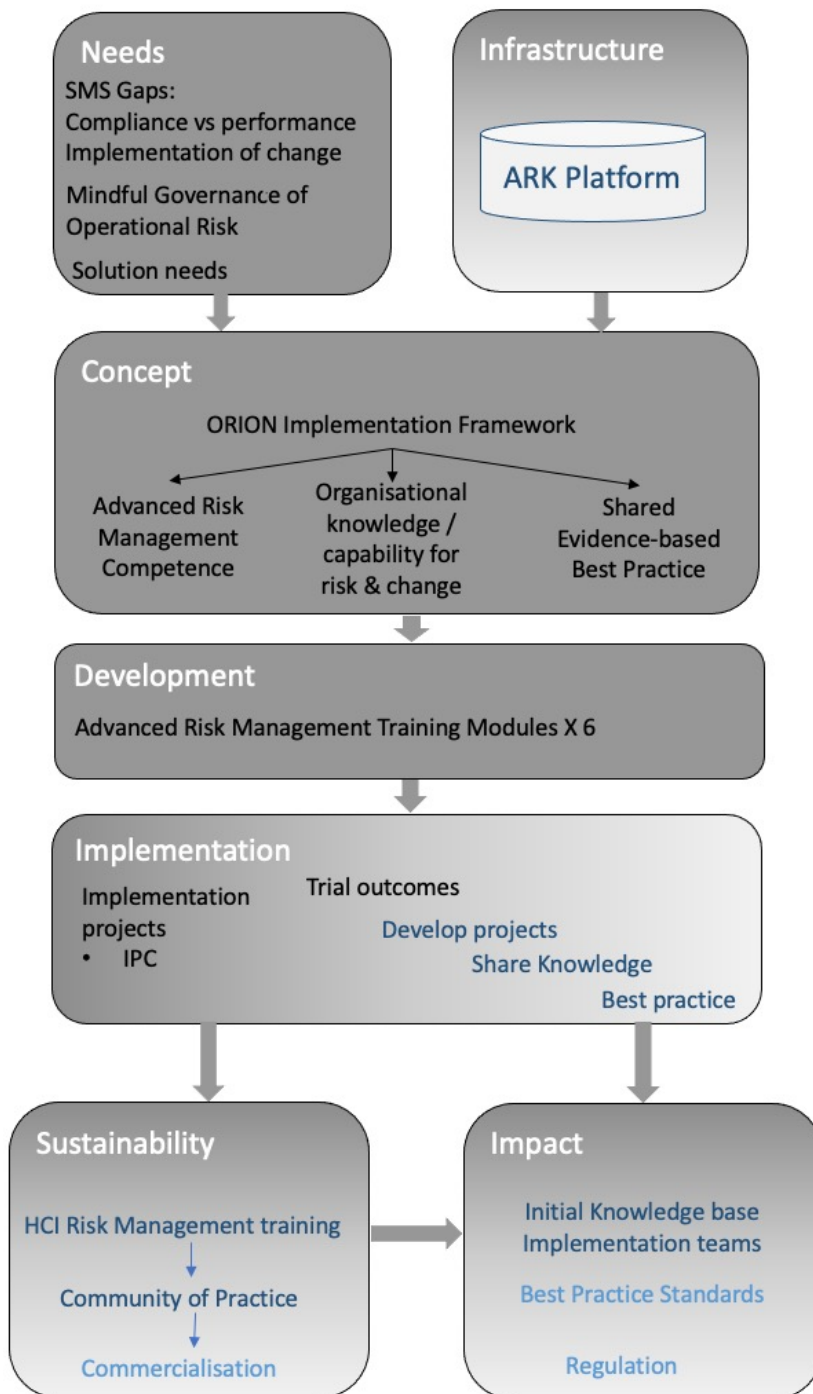
There needs to be a viable pathway to deliver the solution. The goal of a mindful organisation, supported by a mindful knowledge system is not yet implemented but the first steps have been taken. The ORION training programme has been developed and beginning to deliver Professional Competence. The ARK platform prototype has been developed and is undergoing further development. It is beginning to support the Organisational Capability to implement interventions and to gather organisational level knowledge about initial projects formed and to be continued. There is a commitment to develop System-level Knowledge across the Community of Practice. There is a development and delivery roadmap going forward leading to a sustainable solution. This includes the production of the Advanced Risk Management course as part of TCD's on-line training programme, further building the Community of Practice, supported by ORION training, leading in time to ARK commercialisation, supported by ORION training.

## Impact

The impact so far is evident in the initial knowledge base arising from the IPC projects and the development of effective and committed implementation teams. Looking further ahead the impact will be measurable through a contribution to best practice standards for practical infection prevention and control initially in the context of COVID-19, and then in a wider IPC context. Engagement with regulatory agencies will seek to embed these best practice principles within regulatory guidelines. The ORION Implementation Framework will also contribute to a next generation governance model of safety and risk management.

This development trajectory of the ORION Implementation Framework is laid out in Figure 1, below.





Key Black: Already developed/in operation; Dark blue: in progress; Light blue: to be developed

Figure 1: ORION Implementation Framework Development Trajectory

## ORION Conclusions and Next Steps

The ORION project has focused its efforts on the design, development and delivery of a safety management system (SMS) training programme. This is intended to provide a roadmap implementing and advancing safety risk management across multiple sectors including aviation, healthcare and emergency response. ORION is intended to be utilised by other safety critical sectors across the EU and internationally that can benefit from the results of this project.

The ORION project results will be freely available through the Erasmus+ Project Results Platform. This will ensure that the result will remain accessible and available for use at local, regional, national, European wide and internationally. ORION project partners will also make these results available and will promote these through their networks. In addition to making the results available ORION will be actively used and disseminated to ensure optimal impact and sustainability in the drive to advance safety risk management. The planned next steps towards realising this aspiration towards a knowledge-rich ORION Implementation Framework is as follows:

### Continuity of ORION

The immediate objective of ORION is to develop the existing projects further and extend the delivery of ORION training. This needs to be done in a flexible way to support project implementation and to be sensitive to the diverse levels of knowledge and understanding of different users. One means to achieve this will be to build on the existing ORION target groups through the Community of Practice that has been evolving through related projects (e.g. ARK-Virus). The ARK-Virus project development effort will build the resulting evidence base within each organization and then sharable between organisations in the Community of Practice. This will generate a common model of best practice in relevant areas of IPC. This best practice then becomes a resource for the ORION training. Evolving best practice is thus the keystone of developing professional competence.

### Education

The ORION training has been developed to be made available as a regular on-line course delivered by Trinity College Dublin, through its Human Capital Initiative, contributing to Continuous Professional Development (CPD) credits, and will contribute to an existing micro-credentialising system leading to Certificate, Diploma and Masters qualifications. Stamina, Ergonomica and KTH are supporting the development and delivery of the Human Capital Initiative CPD courses.

### Training

ORION training material will be utilised in SMS training delivery by the project partners. For example, Kratis will use training material from ORION, which will be customised and used for upcoming SMS training projects in the Aviation and Healthcare sectors. There are three upcoming projects on Patient Safety in healthcare (Nicosia General Hospital, Plato Rehabilitation Centre and NIPD Genetics) and one in Aviation (Presidential Flight - Abu Dhabi). The Human Factors Network led by KTH are planning a two-day course over a weeks period in which ORION's training will be presented and marketed for organisations in

various sectors to show what ORION has to offer for future collaboration in training or research.

### Research

ORION results have already fed into other research proposals. For example, the upcoming Erasmus+ project Safety Management Systems for Emergency Medical Services (SMS4EMS) is taking both ORION and previous Erasmus+ project CRM4EMS as the starting point for developing a specific SMS training programme for emergency medical services. This is in acknowledgement of the evaluation from EMS practitioners that recognises the need for core SMS training that will help the EMS sector develop SMS capability that incorporates a patient safety component.

### Commercialisation

A commercialisation programme has been initiated for the ARK platform since its development was first supported by the Enterprise Ireland Commercialisation Fund. The ORION programme is a critical part of delivering a sustainable future for Advanced Risk Management and Advanced Risk Knowledge. It will help to gather a growing customer base as a sustainable Community of Practice. In turn this will continuously develop and extend the Knowledge base which is the key value of the enterprise. Currently, this programme is in a pre-commercial phase, but the next year of development and implementation will lead to the formation of a commercially sustainable partnership to continue delivery.

### Regulation and Standards

There will be a focused engagement with regulatory and commissioning agencies, and professional associations, first at national level, then at European, and full international levels. The initial phase of this will be managed through the ARK-Virus project. The fourth edition of the ICAO safety management system acknowledges the need for continuous development and improvement to SMS for aviation. The ORION approach can contribute to further developments and ORION partners who are members of aviation safety networks (e.g. Kratis with EASA) will seek to inform the ongoing development of safety standards and regulations. In addition, the recent WHO Global Patient Safety Action plan sets out the need for a systemic risk management approach in healthcare. ORION will continue its development in alignment with this and an upcoming project Safety Management Systems for Emergency Medical Services (SMS4EMS) will further develop the concepts and content from ORION.

## Contacts and links to organisations etc.

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