Safety of digital and data driven systems: capability mapping

March 2021

Lloyd's Register Foundation is looking to commission, via a grant, an evidence-based map of the capabilities for managing the safety of digital and data driven systems. The research will explore the following aspects of the safety of digital & data driven systems:

1) What are the current capabilities for managing the safety of digital and data driven systems in different geographical, technical and industrial domains
2) What gaps are there in the capability and management of the safety of digital and data driven systems
3) What global and/or regional and/or sector efforts are there which take a holistic view across domains to generate coordinated activity
4) Are these approaches successful in mitigating future risks and hazards as industrial systems become increasingly interconnected
5) Are there coordinated activities bringing safety and security expertise together to tackle future risks

Interested applicants are asked to respond to the brief below with a proposal up to the value of **£75,000.** The deadline for the project's completion is **December 2021.** The deadline for applications is **21 May 2021**. Please see below for full details.

Introduction to Lloyd's Register Foundation

Founded in 2012, Lloyd's Register Foundation is a UK charity with global reach and the sole shareholder of the Lloyd's Register Group. With a mission to protect the safety of life and property, and to advance transport and engineering education, the Foundation has an important role to play in meeting the challenges of today and the future. For more information about the Foundation and the critical infrastructure-related challenges it focuses upon, read our new strategy, launched in 2019.

The strategy includes a challenge focused on the safety of digital and data driven systems. For this call we are defining a data driven system as a system that uses large scale data sets to manage (and sometimes - in the case of autonomy – to make decisions on) the future state of that system. Examples of this can be found in manufacturing where industrial control systems make decisions based on sensor data, or the use of artificial intelligence to correct the dose on a syringe pump based on the patient's vital signs. These devices and systems present information and make decisions using data from sensors and other embedded instruments to control, manage and maintain operational systems across sectors such as manufacturing, process industries, automotive, maritime and many others. As sectors transition towards increasing usage of digital technologies which collectively form part of the 4th industrial revolution (such as robotics, the internet of things, mobile computing etc.), data driven systems are expected to grow and become ubiquitous across industrial settings. The Foundation's work is therefore to understand

what future safety risks there might be and to mitigate these by embedding safe practice within this growth.

Task Outline

The Foundation is seeking to better understand what knowledge is being built & applied, and what regulatory, technical and behavioral approaches exist to support the safety of digital and data driven systems. In sectors and sub-domains such as robotics, wireless communications, artificial intelligence and 3D printing there are a broad range of different approaches which seek to maintain the safety of the system. These approaches will take many forms and may exist as a globally published standard, technical guidance within a corporation or best practice stated in an open source document. As industrial sectors converge on and grow their use of technologies to generate benefits such as increased productivity and efficiency, the approaches currently used to maintain and manage safety may no longer be fit for purpose, or in some cases generate conflicting guidance. At this systemic level of converging technologies, it is unclear if there are existing or emerging approaches to maintain or manage the safety of the increasingly complex system.

The Foundation is seeking to develop a map that provides an evidenced overview of the state of knowledge and practice in each domain and highlight any gaps that emerge. Additionally we are seeking to understand what evidence exists to assure that these approaches are successful in practice. We are also interested in understanding whether approaches at the systems level, working across different technical domains, have been generated and/or successfully applied. The result of this work will inform a second stage which seeks to understand whether a repository of good practice and gaps in existing knowledge is worthwhile developing and curating as an ongoing source of guidance for practitioners.

The Foundation has previously published work in this area such as foresight reviews on cyber security for the industrial internet of things, robotics and autonomous systems and big data. In addition to these there are existing Foundation funded programmes that have produced relevant information and reports such as the Assuring Autonomy International Programme (AAIP) and the 'OK Computer' report from our work with The Global Manufacturing and Industrialisation Summit (GMIS).

The Foundation is seeking to commission a review of existing data, grey literature (for example from industry bodies and professional associations), published evidence and expert interviews on the technical, regulatory and behavioral approaches that support the safety of digital and data driven systems, which will take the form of a charitable grant. We expect successful applicants to use their network of contacts across domains, sectors and geographies to support the research.

Scope

The following points are provided to give context and to help shape the project:

- In sectors aligned with the mission of the Foundation (such as infrastructure[1], maritime, food and manufacturing) what does good practice look like for the safe management of digital and data driven systems?
- What technical & sociotechnical gaps exist in these sectors that impede the safe management of the systems?
- Is there evidence that validates these approaches or that underpins their creation and design?
- Which approaches are most successful and are there common features which could be used to support other sectors or industries?
- How are safety and security managed together in these sectors and are there effective techniques that can be highlighted?
- Are there instances of approaches to manage safety at the systemic level where combinations of technologies converge?
- What current or emerging activities are there to identify and provide guidance on future risks to the safe and secure management of digital and data driven systems?

Outputs

- Publication-ready text for a public-facing report (that the Foundation will have designed for digital platforms and / or print).

- A map or diagram providing an overview of practice in different technical domains and sectors. This should also highlight where key gaps are found.

The submitted text should include a one-page handout summary of the work; an executive summary (approx. three pages) and then the report (approx. 25 pages). Further detail can be included in appendices, for example:
- outline of methodological approach
- list of interviews conducted
- databases and other sources searched / consulted
- bibliography

Please note publication strategy and timelines will be agreed upon completion and will be dependent on what we learn and how they could form part of a wider publication strategy.

Timescale

Webinars	**26 April 2021 – 1pm to 2pm** **28 April 2021 – 9.30am to 10.30am**
Deadline for applications	**21 May 2021**
Applicants receive response by	**21 June 2021**
Deadline for draft outputs for review	**Mid November 2021**
Final deadline for completed outputs	**22 December 2021**

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[1] Infrastructure defined as the following broad sectors water, waste, transport, energy and information technologies.

Requirements

Interested parties are asked to outline their proposed approach using the question prompts below and submitted via the Foundation's online funding portal https://lrfoundation.flexigrant.com/ **by 21 May 2021**.

For this work the Foundation will convene an Expert Advisory Group (EAG) to act as periodic reviewers of the work at points throughout the research process.

A budget of up to £75,000 is available for this work. The successful applicant organisation will receive 50% of agreed scoping stage funding upon contract signing and 50% upon project completion.

Name of organisation:	
Description of organisation:	
Number of employees (approx.):	
Address of organisation:	
Name of primary contact:	
Email address of primary contact:	
Phone number of primary contact:	
What is your proposed approach to the tasks outlined?	
What input would you need from the Foundation - e.g. advice on organisations and publications to consult? (The Foundation and grant-holder will schedule regular communications for advising and updating.)	
What capacity and capability does your organisation have for this work?	
What experience does your organisation have in conducting similar work?	

What (approximate) budget would you need to complete this work? Please include a detailed breakdown of costs including, for example: staff time and day rate, travel, databases or other subscriptions:	

Questions?

Please contact info@lrfoundation.org.uk with the email subject 'Safety of Digital and data driven systems evidence review'.

Change Log

Name	Version	Date	Change
Chris White	1.0	28/01/2021	1st Published Draft