Living Lab 7: Pipeline Data Exchange Structures for cross-border supply chain data

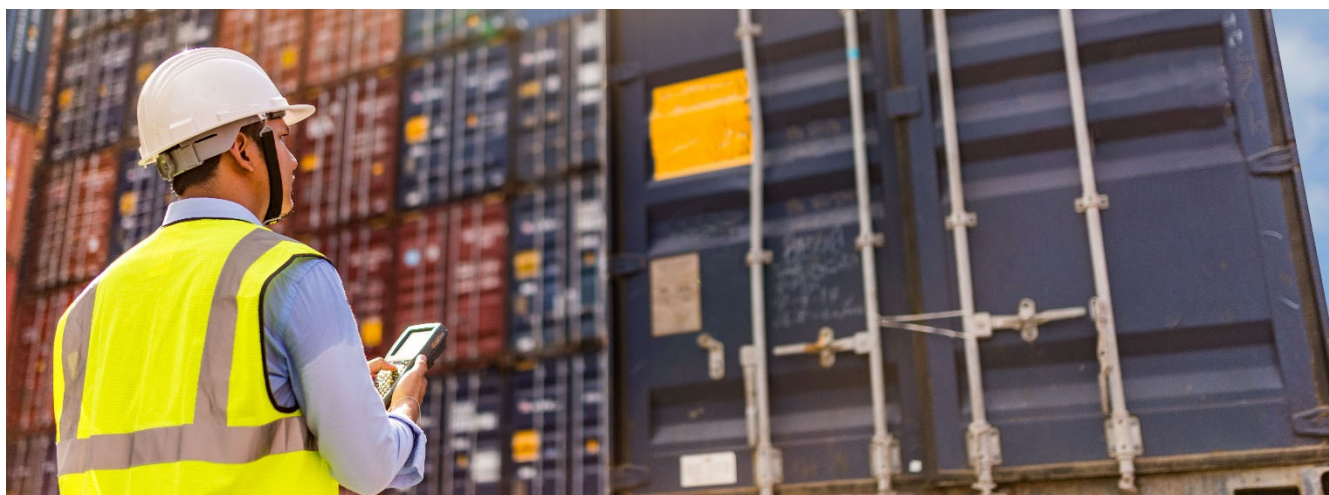

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1 Background and Introduction

1.1 Background

Europe is considered as one of the global leaders in the logistics sector. Eight EU Member States are ranked among the top 10 countries in terms of logistics performance for the year 2018[i], while the market size of the logistics sector in Europe was estimated as being equal to €878bn in 2012[ii].

However, in various sectors, logistics costs remain a significant part of total supply chain costs. These logistics costs represent 12% of total cost in the manufacturing sector and more than 20% in the retail sector[iii]. Moreover, logistics efficiency could be improved. Statistics have shown that 24% of all vehicle movements per kilometre in the EU are not carrying goods, while the average load factor for vehicles is estimated as being 57%[iv].

To enhance efficiency in the EU logistics sector, increased collaboration could improve the current situation. More efficient synchronized networks and a decrease in operational costs are the main benefits for the companies involved in cooperation schemes[v], as it has been estimated that cost savings and efficiency gains of 6-10%, according to Transport Intelligence[vi], or a reduction of 9-30% in distribution costs, could be expected[vii].

1.2 SELIS

However, a key barrier to collaboration is doubts around secure data exchange, and this is the barrier that SELIS aims to remove. The Shared European Logistics Intelligent Information Space

(SELIS) project is a €17 million European Union Horizon 2020 Research and Innovation Programme, running from September 2016 to August 2019. The project has built a scalable and replicable platform for pan-European logistics applications, at every level allowing a standardized exchange of core data between any number of registered users.

The SELIS project has combined strategies for innovative, efficient and green logistics with leading edge open source information technology techniques that support collaborative logistics, through building Living Lab environments and applications, then testing them in real world use cases.

1.3   Living labs

Living Labs have been used by SELIS as the testing and proving environment by using current commercial and operational scenarios to test and refine the SELIS developed technical solutions. Some solutions incorporated opensource systems integrated into the overall platform.

The SELIS Living Lab activities have included the stress-testing of the solutions developed for building the basis for a safe, secure, reliable and robust data-sharing platform.

- Each Living Lab has involved business partners willing to support the development and piloting of their respective applications.
- Each of these Living Labs has tested one or more applications, with each test consisting of one or more demonstrators or use cases. These have enabled the testing of the developed solutions in a number of scenarios, with different groups of collaboration partners generating a set of KPI results which can be compared with the originally anticipated benefits.
- The Living Lab results have enabled insights to be gained with regards to enablers and barriers to the future success of the tested environments and applications.

1.4   The Concept of SELIS Community Nodes

SELIS has developed the concept of a network of logistic communities, each created as localized shared intelligent logistics information spaces, each adaptive, configurable and providing the privacy and data protection that collaboration requires. These communities are termed as SELIS Community Nodes (SCNs). The aim is to stimulate the growth of a network of these SCNs, that will create a distributed common communication and navigation platform for transport and logistics, a platform that, through multiplication, can be extended and expanded to support Pan-European logistics applications, adaption and collaboration.

An SCN could therefore offer a secure domain where supply chain partners could share raw data, analytics predictions, inventory, routing decisions and so on, in a secure and governed manner that, in turn, could enable the implementation of a specific collaborative logistics model.
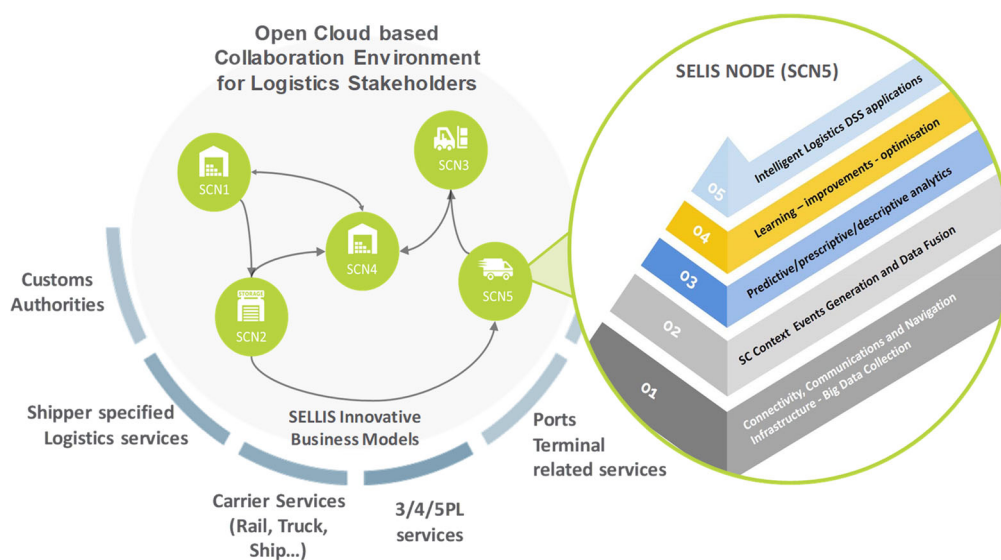
Figure 1: SELIS SCN concept

An SCN includes the necessary architecture to allow data publishers and/or subscribers to:

> 1 - connect to multiple data sources;
>
> 2 - transform, reformat and normalize data;
>
> 3 - share data securely by means of user-defined access rights, thereby enabling collaboration;
>
> 4 - make use of machine learning that allows for self-learning and improving capabilities, such as continuous improvement in forecasting based on the ongoing and real-time use of accumulated data.
>
> 5 - adapt and deliver the capability as required by a specific industry or sector.

If appropriate, an SCN could communicate with other SCNs through an open and cloud-based architecture to create a network of SCNs; this would allow any operator to connect with another, such as a single port SCN, which could share appropriate data with an inland 3PL or rail SCN.

2   Living Lab 7 - Pipeline Data Exchange Structures

2.1   The problem - incomplete or poor-quality data at the border slows down supply chains

In today's global supply chain business processes, information about transactions resides in siloed business and government systems. The information which is shared is often reinterpreted or filtered. As a result, the flow of goods is accompanied by information streams of poor quality. The lack of reliable, accurate and complete data makes it hard to achieve supply chain visibility. This, in turn, makes decision making, risk detection, efficient risk management, supply chain optimization by companies and appropriate supervision by cross border inspection agencies very difficult.

Figure 2: Current supply chain data at the border

The consequences for the supply chain include:

- Too many consignments are being stopped unnecessarily for inspection under precautionary measures.
- Legitimate trade is delayed, affecting logistics planning and visibility, meaning significant additional costs for all parties concerned.
- Precautionary targeting of legitimate goods results in cross-border agency resources being monopolised unnecessarily when they could be used for better-targeting of fraudulent trade.

Past and current EU and UN projects have aimed at supply chain data digitization, as shown below.

Figure 3: Projects involving digitization of supply chain data

The Living Lab 7 business partner, Conex, MGI, Marine Traffic, and eBOS Technologies, worked together to explore solutions using globally standardised data, multiple filing and data pipeline principles.

2.2   SELIS LL7 solution

The SELIS LL7 solution makes use of UN/CEFACT global standards, and, in particular, the multimodal transport reference data model (MMT RDM) was used as a basis to build the Pipeline Data Exchange Structure (PDES), which provides a common structure and scalability to allow many actors in the supply chain to make advanced supply chain quality data available to cross-border agencies. Under this principle, it is possible for multiple parties to provide information that they are responsible for (snippets of data) to build a complete source of truth which can be used for improved border management.

The PDES standardised data can then be presented to the cross-border agency through the chosen delivery method. In SELIS the preference was to utilise the SCN, a publish/subscribe (pub/sub) environment which participants can use to make data available for subscribers to receive in a timely manner only the data that is pertinent to them.

By transferring data streams from multiple parties instead of sending documents, the traditional manual processes can be automated, and tools can be built to support decisions or make predictions, for example:

By subscribing to the vessel voyage data, it was possible to identify potential risks such as proximity to other vessels, periods when AIS data is unavailable and when vessels are passing through prescribed territories that are identified as high risk. This risk-related data was then published for cross-border agencies to examine.

The use of a dashboard allowed Decision Support Systems (DSS) to be put in place for logistic service providers, highlighting potential risk indicators (figure 4).

Figure 4: Waypoint data and exception-based reporting

As shown below in figure 5, LL7 identified the required data elements for a given waypoint at which they are originally available. These multimodal waypoints capture the key data fields needed for efficient cross-border management and which are aligned with pre-arrival regulatory formalities.
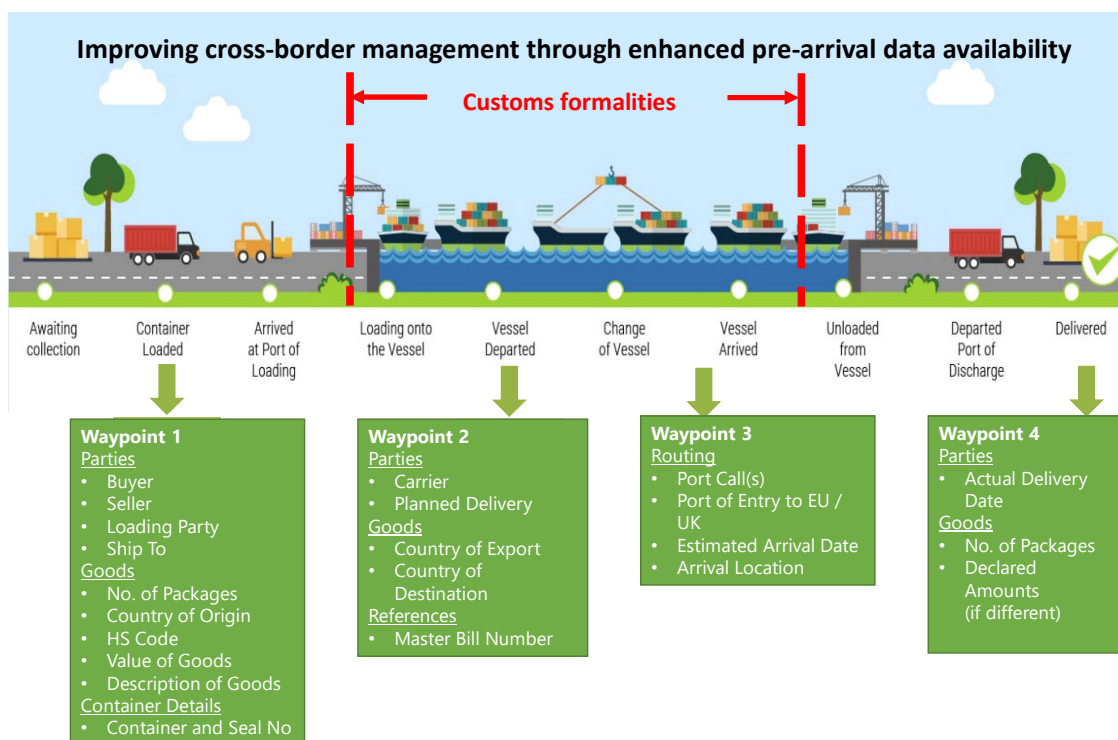
Figure 5: Waypoint Data

In the context of LL7, an SCN was established with:

- PDES data repositories,
- user interface and dashboard,
- a prototype risk analysis engine.

Example scenarios were tested:

- Evaluation of the impact of the availability of better-quality advanced data on cross-border release times. The assumption that better quality advance data would reduce the consignments requiring intervention was tested. This has been evaluated by having cross-border agencies review planned stoppages based on current manifest type data and comparing side-by-side with LL7 PDES data to determine whether a different decision could have been made earlier thanks to this data, as illustrated below in Figure 6. This measurement required feedback from the cross-border agency.
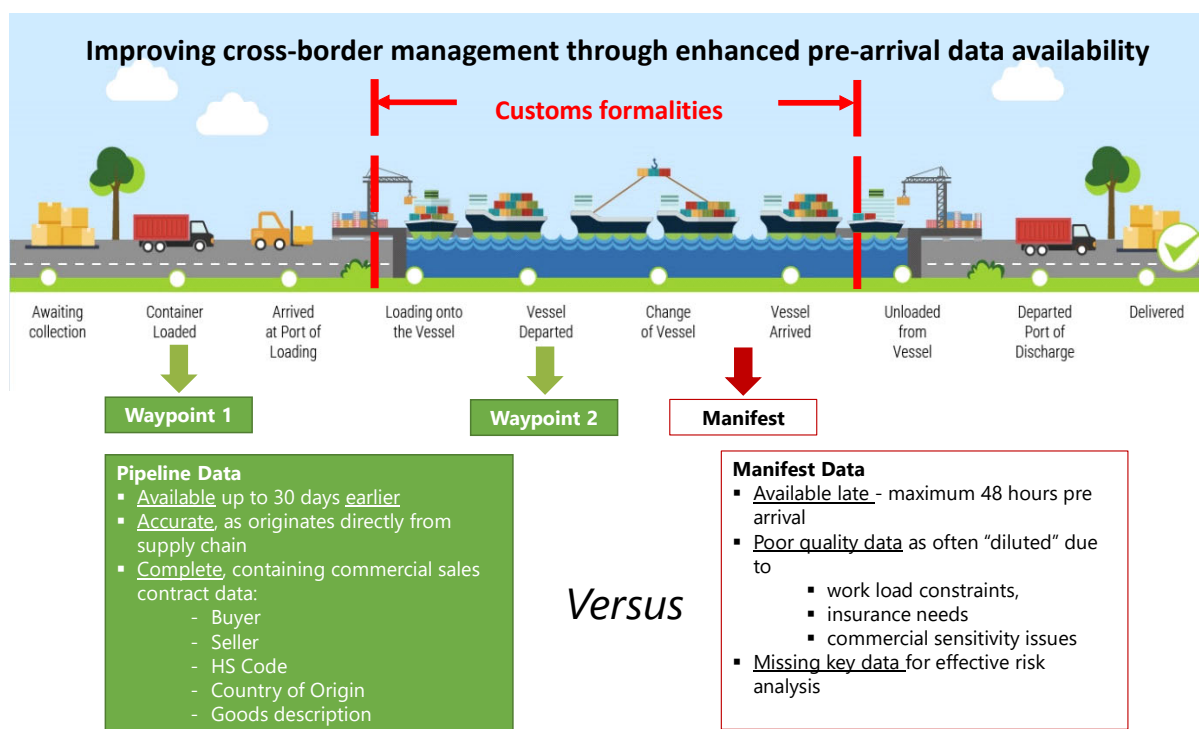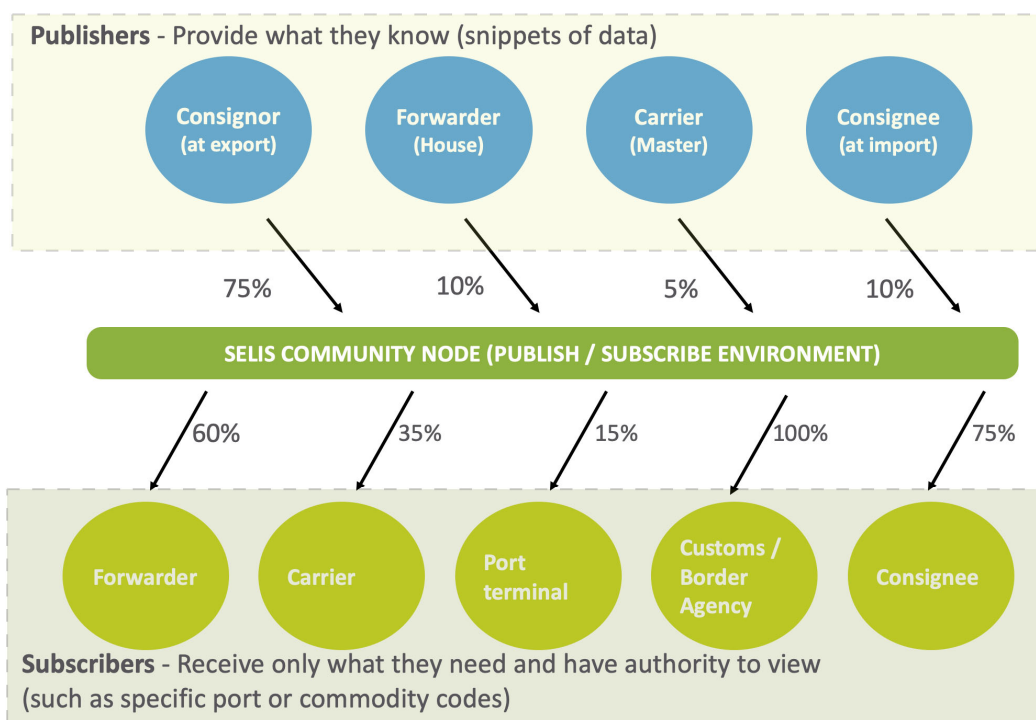
Figure 6: LL7 Demonstrator 1

- Evaluation of how SELIS anticipated risk detection can have a positive impact on cross-border release times thanks to the use of better-quality data. To evaluate this, the number of data inconsistencies between SELIS trade flows and non SELIS trade flows was compared and then an evaluation of whether this would have an impact on cross-border controls and process efficiency (Time) was made. The SELIS and non SELIS trade flows were extracted from a Cargo Community System.
- Another example involved the impact of "intention to control" notifications between cross-border agencies and port actors. To evaluate this, the number of "to be controlled cargos" arising in SELIS trade flows and non SELIS trade flows was compared and then an assessment made on the impact on cross-border control and the time taken for goods to pass through the border.

Cross-border agencies were provided with the most complete data within the SCN pub/sub environment as illustrated in figure 7 below. The partial data gathered from a range of sources enables the full picture to be delivered to cross-border agency, whilst the privacy and confidentiality measures within the SELIS model limited data published to other supply chain actors based on their role and authority to access the data.

Figure 7: Customs and border agencies have the authority to view the complete dataset

2.3 Living Lab 7 Results

LL7 is proud of the many achievements it has made, including:

- creating three aligned PDES data sets for the LL7 Demonstrators
- having the Demonstrator 1 PDES globally recognized and soon to be published as a UN/CEFACT standard
- securing technical engagement with governments to test PDES data as a proof of concept (POC). This POC is in progress and the results are due towards the end of this year.
- promoting, both within the SELIS project and outside it, the re-use of global standards, particularly the UN/CEFACT RDMs for enhanced supply chain data exchange
- highlighting the particular needs of the LL7-related supply chain data access security challenges and communicating them to SELIS technical partners, leading to recognition of their significant value in the development of the "SCN Identity and Access Management (IAM)" component
- obtaining extremely important and highly constructive feedback from supply chain stakeholders, including both traders and cross-border agencies, and implementing the refinements suggested which will be useful for future uptake of the LL7 principles

2.4   Business Impact
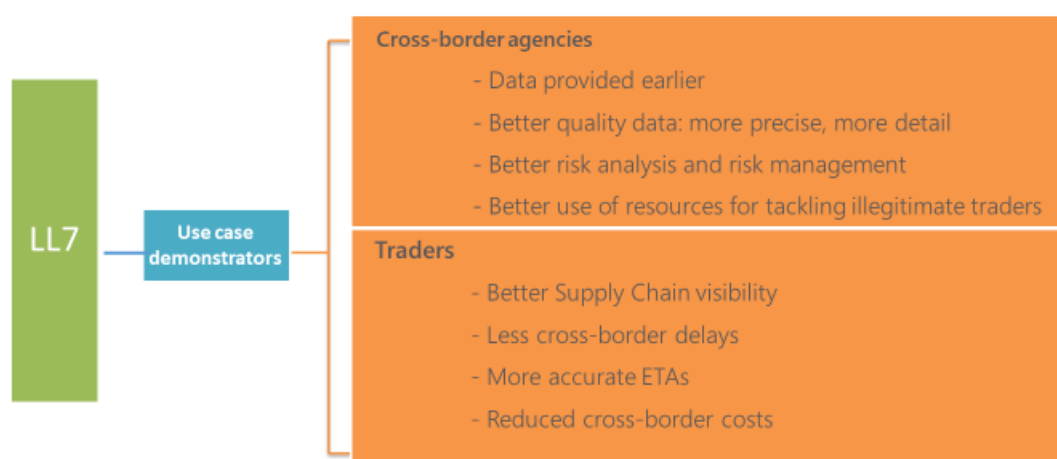
Figure 8: LL7 supply chain benefits

Due to time constraints and Brexit uncertainty, EU government agencies were unable to engage the level of resources to the project as had been hoped. However, valuable feedback based on evaluation of the LL7 principles has been analysed and the results are shown in figure 8 above. In addition, governments are willing to consider the benefits they could offer to trade in return for voluntary pipeline advance data, such as "Green Lane" treatment at borders and "Trusted Trader" status.

2.5   Advisory Board and International Agency Input

This project has resonated with a number of international agencies including the UN/CEFACT and WCO. LL7 was encouraged to present work as it unfolded at a series of workshops and conferences. There was a general consensus that LL7 was working in the right direction and its concepts and solutions will be important for cross-border trade at an international level and could be used to create globally accepted standards.

The Advisory Board delivered similarly encouraging comments in terms of the development of global standards.

3   Conclusions

3.1   Lessons Learnt for Future Development and Implementation

The SELIS testing depended on the willingness and ability of cross-border agencies to technically embrace the advance-filing solution. However, BREXIT uncertainty meant that engaging with cross-border agencies on a technical level was a challenge, and the delays and lack of engagement with the SELIS solution meant that KPIs were less complete than planned and much of the feedback was qualitative.

Further to discussions with cross-border agencies, one of the areas of interest is the possibility of accessing the true consignor-consignee data, as today the majority of consignments contain only agent-to-agent details and this information requires further investigation in order to understand source of trade and to clear consignments. The ultimate objective of the cross-border agencies is to

identify non-conformant traders and it was agreed that through the use of additional or advance data, legitimate consignments can be cleared more efficiently, thereby allowing agencies to focus their resources on the remaining consignments.

3.2 Any Further Next Steps and Recommendations

The UN/CEFACT PDES standard should be promoted for future adoption by multiple cross-border agencies for the future voluntary provision of higher quality advance data from supply chain actors to supplement existing regulatory data requirements.

Other recommendations include:

- Promoting the re-use of globally recognized supply chain Reference Data Models (RDMs)
- Promoting greater interoperability between UN/CEFACT RDMs and the WCO DM to increase understanding between trade data semantics and regulatory data requirements
- In order to use PDES principles in other modes of transport:
  o PDES data sets will require adaptation to suit the different transport mode environments;
  o some cross-collaboration will be required so that interoperability can be achieved. EG: IATA One Record (Air), e-CMR (Road).

Although Big Data was not used in the LL7 project, it is evident that well-documented semantic definitions would be beneficial to its future applications. As LL7 has developed a globally standardized set of semantics for cross-border cargo movements, it is recommended that this work should be considered in the future for aiding risk analysis using Big Data techniques.

4 Further questions

If you wish to ask further questions of the teams involved in this project, please contact Stephen Rinsler (steverinsler@elupeg.com), or Beatriz Royo (broyo@zlc.edu.es).

The SELIS website is https://www.selisproject.eu/

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