Living Lab 1: Freight Forwarders and combining data for shared route planning and optimization

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

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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 (Shared European Logistics Intelligent Information Space)

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 combined strategies for innovative, efficient and green logistics with leading edge open source information technology techniques that support collaborative logistics, through building applications and 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 involved business partners willing to support the development and piloting of these applications.
- Each of these living labs tested one or more applications, with each pilot containing one or more trials, or use cases, which allowed the testing of developed solutions in a number of different scenarios, with different groups of collaboration partners, each effectively conducting a stand-alone experiment which generated a set of real-world results which can then be compared with the expected and anticipated benefits.
- Each real-world pilot and use case trial created insight on implementation, and the enablers and barriers to success.

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 that collaboration requires. These communities are termed as SELIS Community Nodes (SCNs). The aim is to stimulate the growth of a network of these SCN, 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.

Each SCN is a secure domain where supply chain partners share data (e.g. raw data, analytics predictions, inventory, routing decisions etc.) in a secure and governed manner that, in turn, enables the implementation of a specific collaborative logistics model.

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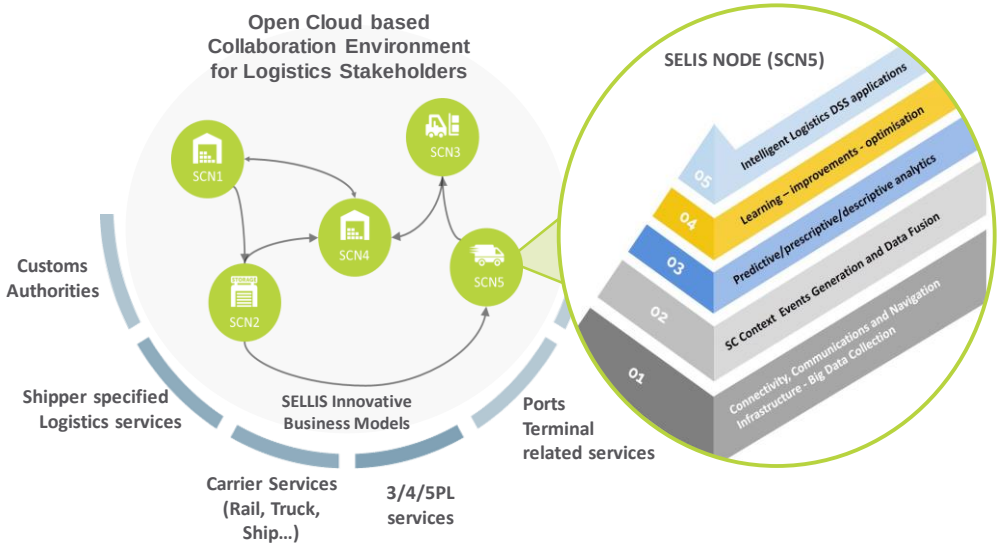

Figure 1: SELIS SCN concept

An SCN includes the necessary architecture to allows users (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 (Third party Logistics provider) or rail SCN.

2 Living lab 1 - Freight Forwarders

2.1 The problem - the operational efficiency of DHL Iberia as a logistics service provider was hindered by a lack of data integration and standardization in the data provided by partners and customers

DHL Iberia provide warehousing and transportation solutions along the entire supply chain for customers from a wide variety of sectors including pharma, automotive, grocery, and consumer goods, and serve customers large and small.

Many logistics service providers must dedicate time and resource to processing and consolidating a range of historical and real-time data, which arrives in a variety of formats and protocols from a range of customers across multiple sectors. DHL are therefore not atypical in having to manage this complexity, and the result is a lack of transparency of the transport service provided. Lack of supply

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chain visibility results in operational costs for DHL, hauliers and customers alike, such as inefficient route planning, and unnecessary opacity that hinders strategic decision making.

2.2 The SELIS solution

SELIS delivered a solution that provided seamless integration and consolidation of transport data, data restructuring and visualization capabilities, as the necessary framework for a new and shared route optimization and planning capability. Information consolidation meant bringing data together from nine different transport management systems, as a necessary first step to enabling a shared and global route optimization. Furthermore, each data provider used their own specific terminology to describe the goods or services it handled and had their own identifiers in the data for each party involved. The first step therefore was normalization of the data, so that data from different sources was interchangeable and comparable. The SELIS communication infrastructure facilitated integration with the various legacy systems, and the SELIS normalization engine was deployed to identify business objects from disparate sources with the same meaning. The automated normalization engine is built upon a set of rules, that can be manually modified by an operator as and when required. Every time that the normalization engine is run, it provides a new set of rules, which again, can be modified as required by the operator, which should mean continuous improvement in the accuracy of the data integration and consolidation. The engine can also handle new input data, through identification and verification as to whether the data is a new value or an error.

SCN to consolidate transport data from a number of Transport Management Systems that was the important aspect. Create routing. For DHL the “global optimization” (route optimization on the consolidated data) is in my view the most important output, that utilizing the normalized and integrated data (from multiple TMSs) generated optimal routes with higher load factors. This one is missing from the Case Study.

The solution required the application of adapters to integrate DHL and SELIS systems, and machine learning and analytics within the normalization engine. Through the normalization of data, a single optimized routing and planning was made possible. To understand the impact of more complete data and shared route optimization, route and truck load optimization data was used to estimate possible cost savings to DHL operations.

2.3 The SELIS components applied

In the application, the data normalization engine was tested and validated including the machine learning required to identify similar data with similar meanings from different sources. The normalisation engine required a user interface for monitoring, configuring and manual intervention, as shown in the screenshot below.

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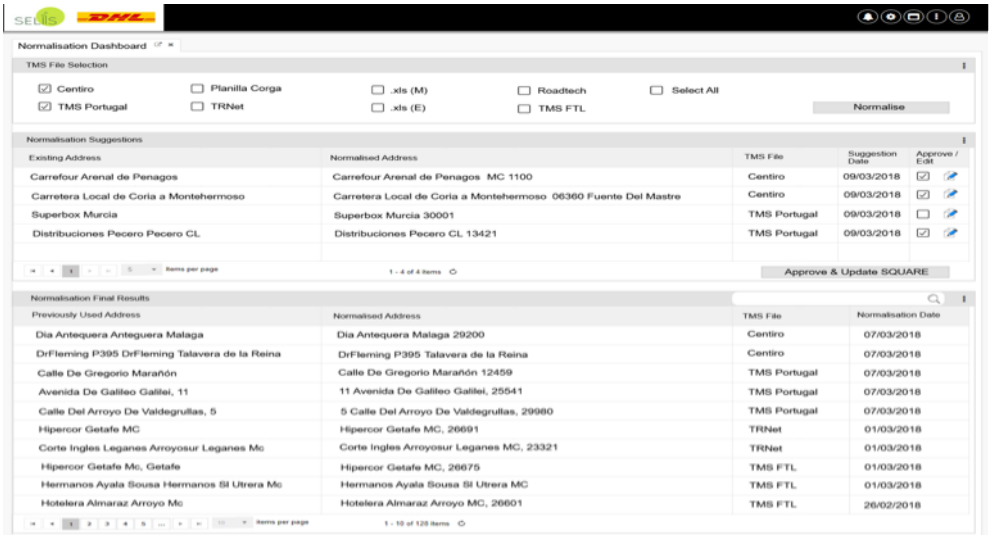

Figure 2: The user and configuration interface of the required data normalization engine

Data integration required installation of communication infrastructure including adapters to link SELIS to DHL systems. To monitor supply chain performance, using the normalised operational data feeds, a data analytics component was implemented alongside a dashboard for DHL consolidation and standardisation of KPI (Key Performance Indicators) and capacity and preventative action (CAPA) tools.

As both a means of demonstrating the operational benefits of data integration, and the strategic cost benefits of sharing the logistics chain, a planning and route optimization prototype was deployed that offered a combined route optimisation for all participants, replacing the sub-optimisation of the use of separate routing and TMS (Transport Management Systems), alongside the route visualization prototype required for the user interface, and the solution is shown in the screenshot below.

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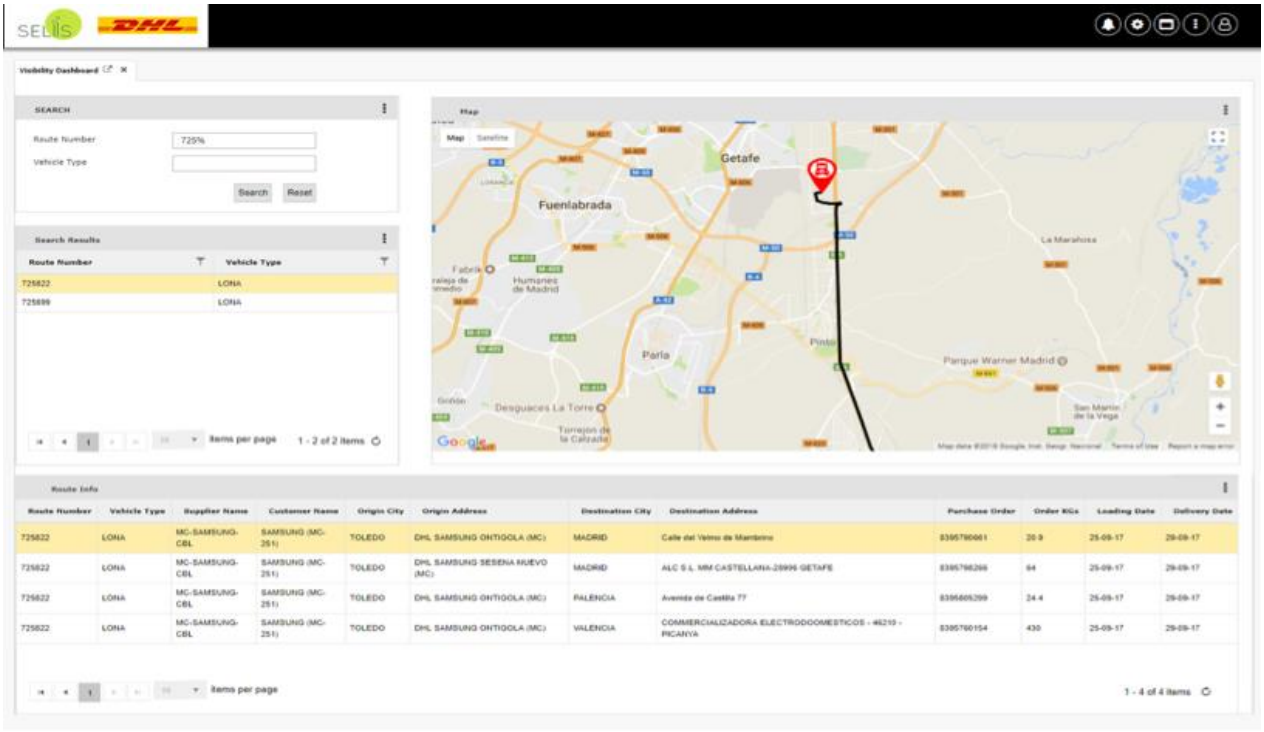

Figure 3: Route and transport events visualization in the new combined routing and planning tool

2.4 Business Impact

As anticipated, benefits included increased internal and external visibility, improved service quality, optimised routing and improved customer satisfaction through reduced response time and better resource utilization. The standardised data and consolidated planning from various Transport Management Systems makes possible facilitated combined global route optimisation solutions, strategic decision-making. This route optimisation from consolidate data allowed for better optimised routes with higher load factors, improving cost management and CO_2 footprint.

The key benefits therefore included

- A global optimisation solution for route planning.

- Simulation of environmental impact indicated reduction in CO_2 emissions of over 5%.

- Improvement of vehicle, driver and fuel utilisation, with a more than 5% increase in round trips.

- Significant quantified savings of over a fifth in the time and resource spent by DHL personnel on the optimisation and management of route planning. This is probably understated for the system as a whole, as the consolidated data should mean less management time involved in the longer term for all partners involved.

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3 Conclusions

3.1 Lessons learnt for future development and implementation

The deployment of data integration and standardization tools is a necessary first step to supply chain collaboration such as combined optimization of logistics routing and transport planning. Such collaboration for combined routing solutions will bring greater efficiencies in the delivery chain, and reduction in costs and GHG (Green House Gas) emissions. SELIS has through this case study demonstrated the practical actions required for, and immediate results delivered from, both the sharing of data and the use of that data to generate real operational improvements that can be shared amongst the participants; the combining of data from nine separate Transport Management Systems allowed for far more effective optimization solutions that benefited all partners.

A key lesson learnt during this case study was that integration of data remains a challenging problem and the initial analysis requires considerable time for addressing errors and gaps in the data provided by different supply chain partners. The normalization engine can identify and improve the matching of data, but the manual intervention required to improve the quality of the raw data should not be underestimated.

However, the case study also shows that whilst data cleansing and quality requires commitment and investment, the returns on that investment can be delivered almost immediately across a wide variety of business objectives, such as combined route optimization and flows, and in doing so can deliver reduction in environmental impact and cost and better use of people and assets. Longer term, the synergies generated through sharing flows of freight should allow for wider network integration and strategic collaboration.

3.2 Any further next steps and recommendations

The impact of combined route optimization and planning delivers a real and tangible return on investment and the opportunity this presents for the wider sector is clear if these benefits can be realized at scale; for example, previous research indicates that one in four trucks on US and EU roads are driving empty or half-loaded. Digital platforms such as those developed and deployed by SELIS within this case study provide an instant snapshot of road transport availability and the ability to access spare capacity in any truck or van that is accounted for within a shared system.

One outcome of the case study is a greater recognition within DHL Iberia of the currently hidden but quickly realizable benefits of data sharing, the necessary data normalization that makes this possible, and the subsequent opportunities this creates for a business model built around sharing of freight flows and capacity for all customers and partners. There remains work to be completed in making the Implementation of data sharing 'Plug and Play'.

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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/

4.1 References

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