

D3.2.1. – Collection of the main innovations in BIG DATA management that could affect the area in the next five years

Elevante srl

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INTRODUCTION

The purpose of this deliverable is to collect and map out the main innovations in big data and data management affecting freight and/or passenger mobility.

This activity was carried out by Elevante Srl (freight) and UniTS (passenger), with the contribution of Actual and University of Rijeka, according to the methodology prepared by Elevante Srl and then presented and approved by all partners.

Collected innovations will be briefly described and presented in order to allow partners to appraise, rank and ultimately select those innovations that are most important and relevant to them. The ranking process will be carried out by means of a comprehensive online survey tool. In the subsequent activities, a more in-depth analysis of some selected innovations will also be carried out.

Collected innovations are divided into:

- Ready-to-be-used and already happening;
- Disruptive innovations (not ready to be used, still being experimented).

BIG DATA AND DATA MANAGEMENT

Big data is an evolving term that describes a large volume of structured, semi-structured and unstructured data that has the potential to be mined for information and used in machine learning projects and other advanced analytics applications.

Big data is often characterized by the 3Vs: the extreme *Volume* of data, the wide *Variety* of data types and the *Velocity* at which the data must be processed. Those characteristics were first identified by Gartner analyst Doug Laney in 2001. More recently, several 3 more V-words have been added to descriptions of big data, including *Veracity*, *Value* and *Variability*. Although big data doesn't equate to any specific volume of data, the term is often used to describe large amounts such as terabytes, petabytes and even exabytes of data captured over time.

Big data challenges include capturing data, data storage, data analysis, search, sharing, transfer, visualization, querying, updating, information privacy and data source.

Real or near-real time information delivery is one of the defining characteristics of big data analytics.

Data sets grow rapidly- in part because they are increasingly gathered by cheap and numerous information- sensing Internet of things devices such as mobile devices, aerial (remote sensing), software logs, cameras, microphones, radio-frequency identification (RFID) readers and wireless sensor networks. The world's technological per-capita capacity to store information has roughly doubled every 40 months since the 1980s¹.

Big data and the IoT (Internet of Things) work in conjunction. Data extracted from IoT devices provides a mapping of device interconnectivity. Such mappings have been used by the media industry, companies and governments to more accurately target their audience and increase media efficiency. IoT is also increasingly adopted as a means of gathering sensory data, and this sensory data has also been used in transportation contexts².

¹ Hilbert, Martin; López, Priscila (2011). "The World's Technological Capacity to Store, Communicate, and Compute Information". *Science*. **332** (6025): 60–65

² Z. Jenipher Wang (March 2017). "Big Data Driven Smart Transportation: the Underlying Story of IoT Transformed Mobility"

PARTNERS

Partners participating on WP3 are

- PP2 – ELEVANTE Srl
- LP – University of Rijeka, Faculty of Maritime Studies Rijeka
- PP1 – CFLI, Intermodal Logistics Training Consortium
- PP4 – University of Trieste
- PP5 – Actual I.T.
- PP6 – Cluster for Innovation in Logistics and Transport System
- PP7 – Port of Rijeka Authority
- PP8 – Port of Sibenik Authority
- PP9 – Rovinj Port Authority

Partners for Freight sector:

- PP2 – ELEVANTE srl
- PP5 – Actual I.T.
- PP6 – Cluster for Innovation in Logistics and Transport System

Partners for Passenger sector:

- PP4 – University of Trieste
- PP 7 – Port of Rijeka Authority
- PP 8 – Port of Sibenik Authority

Partners for both Freight and Passenger sector:

- PP1 – CFLI, Intermodal Logistics Training Consortium
- PP 9 – Rovinj Porth Authority

WP COORDINATION

- Start Date 1.4.2019
- End Date 31.10.2019

Coordinator PP2 - ELEVANTE srl

Involved Project Partners:

- PP2 – ELEVANTE srl
- LP – University of Rijeka, Faculty of Maritime Studies Rijeka
- PP1 – CFLI, Intermodal Logistics Training Consortium
- PP4 – University of Trieste
- PP5 – Actual I.T.
- PP6 – Cluster for Innovation in Logistics and Transport System
- PP7 – Port of Rijeka Authority
- PP8 – Port of Sibenik Authority
- PP9 – Rovinj Porth Authority

DATA MANAGEMENT: DISRUPTIVE INNOVATIONS

Joint desk research carried out by Elevante Srl and UniTs (with contributions from Actual and University of Rijeka) has brought a number of innovations within the big data and data management trend, that are not yet ready to be used. Some of them may already be taking place but in very limited testing environments, very often still requiring regulatory frameworks to keep the pace with technology advancements. Others are in the course of being implemented and turned into real-world applications. Finally, some are still being explored and investigated at a theoretical stage or exists in form of innovative start-up companies fuelled by venture capitals and gathering the interest of investors.

Collected innovations are described very briefly. They will be presented to PPs for their appraisal, ranking and final selection, according to what is important and relevant to each PP. This process will be carried out by means of a comprehensive online survey tool designed by Elevante (as WPL) and implemented by UniTS.

In-depth analysis of some selected innovations will be carried out in later stages of WP3.

Innovations are listed here in no particular order.

Big data/data management (passenger/freight)

Big data management can supply to all the harbour operators readily available information, accurate and realizable in order to improve every process. Digital documents can integrate information for automatic identification, position reports, estimated arrival times, ship details and market information in an exchange portal to find available alternatives, as well as freight transport forecasts. This can enable charterers and ship owners to have access to more options, thereby improving transparency and competitiveness.

Big Data Analytics (passenger/freight)

Through the use of Big Data Analytics technology to collect and analyse customs data, ports agents, freight forwarders and traders, it is possible to predict individual ship movements and cargo flows. One possibility would be a smartphone app that transmits speed and location and offers incentives for the crew to add higher levels of data.

Digital twin (passenger/freight)

The digital twin of an asset is a model capable to reproduce the its state and the behaviour close to real time. Recently the topic is gaining attention in maritime domain, being applied to ships and offshore structures, and likely extended also to ports and terminals. Machine learning and big data analytics can increase substantially the knowledge extraction capability, increasing the reliability of the digital twin and its possible applications.

Data standardization (passenger/freight)

Industry tasks, each with their own data collection, storage, and management, need to be integrated together for a complete picture. Several world's largest carriers, (including Maersk and MSC) have established the Digital Container Shipping Association (DCSA) to create common information technology standards, a common foundation for technical interfaces and data for the maritime industry. On the other hand, port authorities, terminal operators and shipping companies which are already leveraging data to intelligently plan their operations.

Automatic detection of logistics' level of service (freight) (e.g. lead time, etc.)

Through data detection and management technologies such as radio frequency identification (RFID) it is possible to collect and transmit data related to the whole process. Subsequently through the analysis of these large amounts of data it is possible to forecast the performances for a consequent decision support and to improve the logistic efficiency.

Loading/unloading optimisation (freight)

More efficient loading /unloading procedures and planning of resources based on real-time data and AI algorithms.

Machine Learning (passenger/freight)

Usage of big data to feed machine learning algorithms for:

- Assessing the normal speed of mobility of cargo /passengers;
- Correlation of other logistic data to the reasons of mobility anomalies/errors predict bottlenecks based on recognized patterns.

AI-aided decision for corrective measures (for traffic automation).

DATA MANAGEMENT: READY-TO-BE-USED INNOVATIONS

Desk research carried out by Elevante Srl and UniTs (with contributions from Actual and University of Rijeka) has brought a number of innovations in the data management trend, that are already available in the market and already used by a number of entities. These innovations could be brought to programme area without having to wait for further developments. However, local regulatory framework (if necessary) may still be lacking.

Collected innovations are described briefly. They will be presented to PPs for their appraisal, ranking and final selection, according to what is important and relevant to each PP. This process will be carried out by means of a comprehensive online survey tool designed by Elevante (as WPL) and implemented by UniTS. In-depth analysis of some selected innovations will be carried out in later stages of WP3.

Innovations are listed here in no particular order.

Georeferenced data (passenger/freight)

Within the maritime sector, the use of georeferenced data, can be useful to assess the impact of events or scenarios and can save time, effort, and resources before implementing the actual project. Integration of GIS systems within the shipbuilding sector would certainly be helpful in forming a technically competent global maritime workforce.

Energy Efficiency (passenger)

Big Data Analysis can provide considerable benefits to energy efficiency, increasing ship performances during navigation or optimising the governing algorithms of a EnMS.

Port traffic management (passenger/freight)

The Vessel Traffic Management System within a secure network of sensors and collaborative control rooms is able to provide real-time information to various persons responsible for port security.

The system is designed to manage ship traffic in ports, rivers and coastal areas. It is able to provide accurate detection, tracking and identification of small and high speed targets and can generate automatic alarms if the target area approach is limited.

Anomalies detection & predictive maintenance (passenger/freight)

Big data and machine learning techniques can be adopted to identify anomalies or failures on a specific machinery, equipment or system, as well as to program their maintenance (predictive maintenance).

Passengers flow analysis (passenger)

Timestamping of passages position at strategic locations (with IoT, computer vision, artificial intelligence) for findings gaps for process improvements.

CONCLUSIONS

From desk research it emerged that a number of innovations within big data and data management are not yet ready to be used. Some of them may already be taking place but in very limited testing environments, very often still requiring regulatory frameworks to keep the pace with technology advancements. Others are in the course of being implemented and turned into real-world applications. Finally, some are still being explored and investigated at a theoretical stage or exist in form of innovative start-up companies fuelled by venture capitals and gathering the interest of investors.

A larger group of innovations is already available in the market and used by a number of entities. These innovations could be brought to programme area without having to wait for further developments. However, local regulatory framework (if necessary) may still be lacking.

Collected innovations will be briefly described and presented in order to allow partners to appraise, rank and ultimately selected those innovations that are most important and relevant to them. The ranking process will be carried out by means of a comprehensive online survey tool. In the subsequent activities, a more in-depth analysis of some selected innovations will also be carried out.

ONLINE RESOURCES

- **Standards**

- https://www.porttechnology.org/news/qa_how_terminals_can_better_utilise_data#osisoft
- https://www.porttechnology.org/news/insight_embracing_data_driven_shipping?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+18-04-2019&utm_term=%5bPTI+Insight%5d+India%E2%80%99s+Alternative+Silk+Road...Automation+Lessons+from+Other+Sectors...How+Smart+Start-Ups+Are+Changing+Maritime&utm_content=2940&gator_td=ZGwG9DY4iRUvreaq%2bOgVUeHKOLks%2f4JjRDL94o%2f66sc0bWW11xVfFVfU%2fNdyOydHDhRbnQHpn%2fL%2bkvXwtDI8tW6c%2fUq6LXKTPix9cFwTDgHWjlxCSdH6XhH95KNWCSWYAS30pFvAOCjsrR3nSq1n3A%3d%3d
- https://www.porttechnology.org/news/pti_toc_exclusive_konecranes_on_standardization?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+03-04-2019&utm_term=%5bPTI+Daily%5d+Deal+Struck+for+Italy%27s+Biggest+Terminal...Four+Seafarers+Snatched+in+Cameroon+Attack...Tyres+in+Maritime&utm_content=2940&gator_td=ML76u3XFSZRcbf9uxhEgJMOB6NIbJQn CJvrKcYY5B6TDg1Dx3WMn3NWGDN%2bH0ftYXKqkEWR1n8kMDYd%2bfZ5oKXN99qwwl9OwNqwgzJ%2b0E7b216HflNFItfpzbirws1SQsbAh3WSkCAMSI3fxdhHd0w%3d%3d
- https://www.porttechnology.org/news/digital_association_of_major_carriers_officially_formed?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+16-04-

[2019&utm_term=%5bPTI+Daily%5d+New+Paper%3a+DP+World%E2%80%99s+Terminal+of+the+Future...Major+Carriers+Launch+Digital+Association...LA+Rocked+by+Blast&utm_content=2940&gator_td=tBJ%2fqpPs61b9aVKEy0DhGCP%2fHZoMfjKb4ppcZPkVrfwj0vtBix0QPEDjFTscokkQ0EdvrKw9S Sxd2OrZTVYVJiH4Bb51Sp49yex71jY8Wf954QQRyFki93ewsTLz2RQVYW%2f uwBvIAaFePbCE4VCSKg%3d%3d](https://www.porttechnology.org/news/maersk-ibm-adds-zim-to-tradelens/?utm_term=%5bPTI+Daily%5d+New+Paper%3a+DP+World%E2%80%99s+Terminal+of+the+Future...Major+Carriers+Launch+Digital+Association...LA+Rocked+by+Blast&utm_content=2940&gator_td=tBJ%2fqpPs61b9aVKEy0DhGCP%2fHZoMfjKb4ppcZPkVrfwj0vtBix0QPEDjFTscokkQ0EdvrKw9S Sxd2OrZTVYVJiH4Bb51Sp49yex71jY8Wf954QQRyFki93ewsTLz2RQVYW%2f uwBvIAaFePbCE4VCSKg%3d%3d)

- **Blockchain**

- [https://www.porttechnology.org/news/maersk-ibm-adds-zim-to-tradelens/?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+17-04-](https://www.porttechnology.org/news/maersk-ibm-adds-zim-to-tradelens/?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+17-04-2019&utm_term=%5bPTI+Daily%5d+INFORM+Releases+2038+Part+2+Teaser...DP+World++SMS+Revolutionary+Solution...CTAC19%3a+Ask+an+Expert&utm_content=2940&gator_td=sTyGMcpn7WRjKodXlqNqluZyZvZFFov2o56neDn%2fy3gJm%2fXCu6SHdLtH6N53U8%2fqG%2fvUirIEV%2bjAIAFeT8vvjD9CbtqGT2dwCpCO7BxA8vmqelKME%2bRmp3XrmWgLud3ka54KgwilFYSBw22qlTmtQ%3d%3d)

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- **Artificial Intelligence and chip technology**

- [https://www.porttechnology.org/news/siemens-launches-ai-analytics-partnership?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+05-04-](https://www.porttechnology.org/news/siemens-launches-ai-analytics-partnership?utm_source=GatorMail&utm_medium=email&utm_campaign=Newsletter+daily+05-04-2019&utm_term=%5bPTI+Sunday%5d+PTI+Launches+New+AIS+Portal...In+Light%3a+Automation+Lessons+from+Elsewhere...Momentum+Builds+for+CTAC19&utm_content=2940&gator_td=bK%2bleYj7UIVxYUB2My0yVXgVI5j)

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- https://www.porttechnology.org/news/next_gen_computer_chip_for_robotics_released
- https://www.porttechnology.org/news/ai_supply_chain_four_key_predictions_for_2018

- **Machine learning**

- https://www.porttechnology.org/technical_papers/machine_learning_in_container_terminals
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- <https://www.onthemosway.eu/maritime-machine-learning-application-development-begins/?cn-reloaded=1>