Track & Know

Big Data for Mobility Tracking Knowledge Extraction in Urban Areas

D7.3 Dissemination Plan, Communications programme, Website

Document Summary Information

Grant Agreement No	780754	Acronym	TRACK AND KNOW
Full Title	Big Data for Mobility Tracking Knowledge Extraction in Urban Areas		
Start Date	01/01/2018	Duration	36 months
Project URL	www.trackandknowproject.eu		
Deliverable	D7.3		
Work Package	WP7		
Contractual due date	31/12/2020	Actual submission date	31/12/2020
Nature	Report	Dissemination Level	Public
Lead Beneficiary	UHASSELT		
Responsible Author	Lien Aerts		
Contributions from	Edith Donders, Prof. Dr Ansar Yasar, Dr Muhammad Adnan, Jenny Rainbird, Ibad Kureshi, Toni Staykova		

Revision history (including peer reviewing & quality control)

Version	Issue Date	% Complete[1]	Changes	Contributor(s)
V0.5	25/10/2019	75	First version for internal review	Lien Aerts (UHASSELT)
V0.6	07/11/2019	80	TOC exploitation & IPR protection added	Ibad Kureshi (INLECOM)
V0.7	10/11/2020	85	Second version for internal review (excl. annexes)	Lien Aerts (UHASSELT)
V0.8	24/11/2020	90	Original figures & missing info added	Jenny Rainbird (INLECOM)
V0.9	07/12/2020	100	Version for external ethics review & internal review	Lien Aerts (UHASSELT)
V1.0	18/12/2020	100	Revised version	Lien Aerts (UHASSELT)

Disclaimer

Copyright message

---

[1] According to TRACK AND KNOW's Quality Assurance Process:
Due Date - 6 Weeks: Peer Review
Due Date – 2 Weeks: Quality Manager Review (INTRASOFT)
Due Date - 2 Days: Sent to Inlecom for Submission to the EC after addressing all comments by Quality Manage and Peer Reviewers

Table of Contents

List of Figures

List of Tables

Glossary of terms and abbreviations used

Abbreviation / Term	Description
BDA	Big Data Analytics
BDP	Big Data Processing
CDP	Communication and Dissemination Plan
CEL	Cambridge Medical Academy Ltd. (before: Celeritas Medical LTD)
CER	Complex Event Recognition
CNR	Consiglio Nazionale Delle Ricerche
EU	European Union
FRAUNHOFER	Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung EV
GA	Grant Agreement
GDPR	General Data Protection & Regulation
INEA	Innovation and Networks Executive Agency
INLECOM	Inlecom Systems LTD – project co-ordinator
INTRASOFT	Intrasoft International SA
IPR	Intellectual Property Rights
KT	Konnekt-able Technologies Limited
NCSRD	National Center for Scientific Research "Demokritos"
NoDA	Unified NoSQL Data Access Operators
PAPWORTH	NHS Royal Papworth Hospital
PO	Project Officer
SEO	Search Engine Optimization
SIS	SISTEMATICA
TA	Target Audience
UHASSELT	Hasselt University
UPMC	Sorbonne Université
UPRC	University of Piraeus Research Center
UZH	Universitaet Zuerich
VA	Visual Analytics
WP	Work Package
ZEL	Vodafone Innovus

1 Introduction

This deliverable presents the Track and Know Communication / Dissemination Plan (CDP).

The main communication / dissemination ambition is to make knowledge, generated throughout the course of the Track and Know project, available to society without delay and to promote the project and its results towards the relevant stakeholders.

1.1 Mapping TRACK AND KNOW Outputs

Purpose of this section, is to map TRACK AND KNOW's Grant Agreement commitments, both within the formal Deliverable and Task description, against the project's respective outputs and work performed.

TRACK AND KNOW GA Component Title	TRACK AND KNOW GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D7.3 Dissemination plan, communication programme & website	*Report on the dissemination strategy, objectives and dissemination plan, events organisation. Report on the utilisation of communications tools/means such as Social media, Conferences, Workshops, Newsletters, Success Stories* *Factsheets, Articles, Whitepapers, Press Releases, Journal Publications, Policy Briefs etc. Organisation of training courses for end-users on Toolboxes technologies. Evaluation of the dissemination plan.*	*Chapters 3 to 12*	*This document focuses on the dissemination and communication plan, strategic approach and actual realization of the plan via a wide range of media, tools and events in order to reach out to the wanted stakeholder groups and realizing the goals that were set.*
TASKS			
Task 7.1 Dissemination & Training	*This task will set dissemination objectives and design and implement the dissemination plan including material production, project's*	*Chapters 3 to 12*	*After determination of the dissemination goals and KPI's, this document focuses on the Track and Know media mix and its multi-channel approach. Basic principles for the strategy are regular and continuous*

website and social media channels set- up. Events organisation. Communications tools that will be used include Conferences, Workshops, Newsletters, Success Stories Factsheets, Infographics, Brochure (for buy-in) and annual report, Articles, Whitepapers, Press Releases, Journal Publications, Policy Briefs etc. and the Project Website setup. Throughout the project's lifespan, the performance of the dissemination activities will be monitored, evaluated and refined accordingly. The task includes the organisation of training courses for end-users on Toolboxes technologies. The result of the task will be documented in deliverables D7.1 and D7.3.		*communication, comprehensible content which fits the used channel and a continuous effort to raise attention from the desired stakeholder groups via various media, events, tools. At the end of the project, the main focus will be to stimulate the uptake of the project's results by the industries via webinars, workshops, events, etc.*

Table 1: Adherence to TRACK AND KNOW's GA Deliverable & Tasks Descriptions

1.2   Deliverable Overview and Report Structure

The Track and Know Communication / Dissemination Plan (CDP) starts (chapter 2) with a **project summary** to explain the overall goal, purpose and scope of the project, followed by (chapter 3) a summary of the **set of rules regarding the dissemination of publishable output / communication** about the project. These rules protect copyrights and prevent conflicts between partners. Since the consortium had a shared responsibility for dissemination and communication it was important that each person involved in the Track and Know project (whether as researcher or as supporting staff member) was aware of these obligations as set out in the Grant Agreement (GA) and the Consortium Agreement (CA). The following chapters describe the followed **approach, defined Target Audiences (TA) and the TA goals, the tools and activities we use to disseminate/communicate and the tools we use to monitor the impact and effect of our activities on a regular basis**. Also, the **achieved results** are added in several annexes including reports, statistics and a KPI report.

2 Project summary

Track and Know aimed to research, develop and exploit a new software framework to increase the efficiency of Big Data applications in the transport, mobility, motor insurance and health sectors. Stemming from industrial cases, Track and Know developed user friendly toolboxes that are readily applicable in the addressed markets, and are also investigated in additional domains through liaison activities with running ICT-15 Lighthouse projects. Track and Know integrated multidisciplinary research teams from Mobility Data management, Complex Event Recognition, Geospatial Modelling, Complex Network Analysis, Transportation Engineering and Visual Analytics to develop new models and applications. Track and Know recognized that Big Data penetration is not adequately developed in niche markets outside the traditional verticals (e.g. Finance) and so the Track and Know Toolboxes were demonstrated in three real-world pilots using datasets from niche market scenarios to validate efficiency improvements. Performance and impact benchmarks are elaborated and were documented during pilot's deployment. The Track and Know consortium is composed by complementary partners, coming from addressed research, technological and commercial domains, that have a proven track record of high quality research capacity. Thus, the carefully structured work plan, embodies a holistic approach towards meeting the Track and Know objectives and delivering market-relevant outcomes of significant exploitation potential.

As the world's population living in metropolitan areas increases, so increases the need for effective and sustainable interventions and services to inject mobility intelligence and improve the quality of life in large urban environments. Technological developments, in particular the extended and expanding use of ICT, have resulted the collection of unprecedented volumes of data across systems operating in the transport, mobility and the urban applications domains. Moreover, the influence of digital evolution is changing the experience of consumers of services in these domains and is driving the expectations that will shape the demand in the coming years. Although certain markets have been radically changed by the influence of technology, the transport, mobility and urban services sectors are changing at a slower pace and both commercial providers and public operators are very slowly adapting to the current technology offerings.

The existing accumulated large volumes of data, known also as "big data", are generating a strong interest in the research communities, the relevant industries and among policy makers. The adoption of digital services is expected to enable service providers to deliver secure and efficient services across intelligent infrastructures with higher automation capacity. As a result, the demand for efficient and scalable smart services facilitating personalized, adaptable, environmental and sustainable capabilities impose new requirements for the improved exploitation of the immense and continuously rising amounts of data generated by industrial operations, sensors and devices (Internet of Things - IoT), social media and often aggregated Open Data sources.

Increasingly, in smart cities cloud-based infrastructures combined with behavioural, institutional and policy-related data sources create a critical pathway in achieving the four-partite goals of Health, Liveability, Adaptability and Sustainability (HLAS). Elaborating on the cross-domain Big Data Value generation, so far, the most common approaches e.g. for smart mobility focus on tracking vehicles' spatial and temporal information and have not been related with health, adaptable insurance services and life quality indices (i.e. driving and cognitive capabilities, driving skills deterioration, prevention, symptoms early-detection, prediction and control, etc.).

Unfortunately, in today's information society, the ability of retrieving knowledge from mobility and contextual data is becoming more and more critical for the competitiveness of all the economic, political and cultural entities. Companies produce within their individual activities and along with synergies (i.e. traffic monitoring, fleet and healthcare management, emergency response and/or adaptable insurance services, etc.) a huge flow of data coming from diverse domains, different devices, processes, markets, user generated content/feedback or external sources. The rise of ubiquitous connectivity combined with IoT (Internet of Things) is the key enabler for the rise of "Industry 4.0" and already allows acquiring data from an evolving mobile and stationary ecosystem. The more data are available, the more the tools to manage them have advanced. Databases, software, computing power and in general technical infrastructure have grown and improved in the past years, thanks to investments

and research. However, there is a gap between the availability of data and the potential information or knowledge that can be extracted from them: not every enterprise has now the means to analyse such an amount of data. In addition to this, Data Science imposes the tight collaboration among different stakeholders coming from diverse domains (i.e. ICT, Transport, Insurance, Health, etc.) to add value to this kind of data in an intelligent, efficient and scalable manner. But still, this amount of data most of the time remains decoupled and isolated within private infrastructures. Many companies can benefit from data management and analysis in order to infer knowledge by effectively blending data. Knowledge from Big Data is the key for success.

In this direction, Track and Know, by injecting computational thinking capabilities in the context of smart mobility services, aimed to address the challenges of the emerging Big Data Value ecosystem, including the autonomous, connected and shared vehicles technologies, the self-enablement configuration features (such as e.g. in Intelligent Transportation Systems - ITS, self-parking, speed and/or lane control), addressing the questions of what type of information is needed, and with whom, when and how it is used. More specifically, Track and Know integrated multidisciplinary research teams from Mobility Data management, Complex Event Recognition, Geospatial Modelling, Complex Network Analysis, Transportation Engineering and Visual Analytics to develop new models and applications. An insight of Track and Know concept is represented in Figure 1 (source: www.bdva.eu), providing an overview on how the aforementioned challenges are going to be addressed conjunctively and towards providing a coherent Big Data Framework and related solutions.
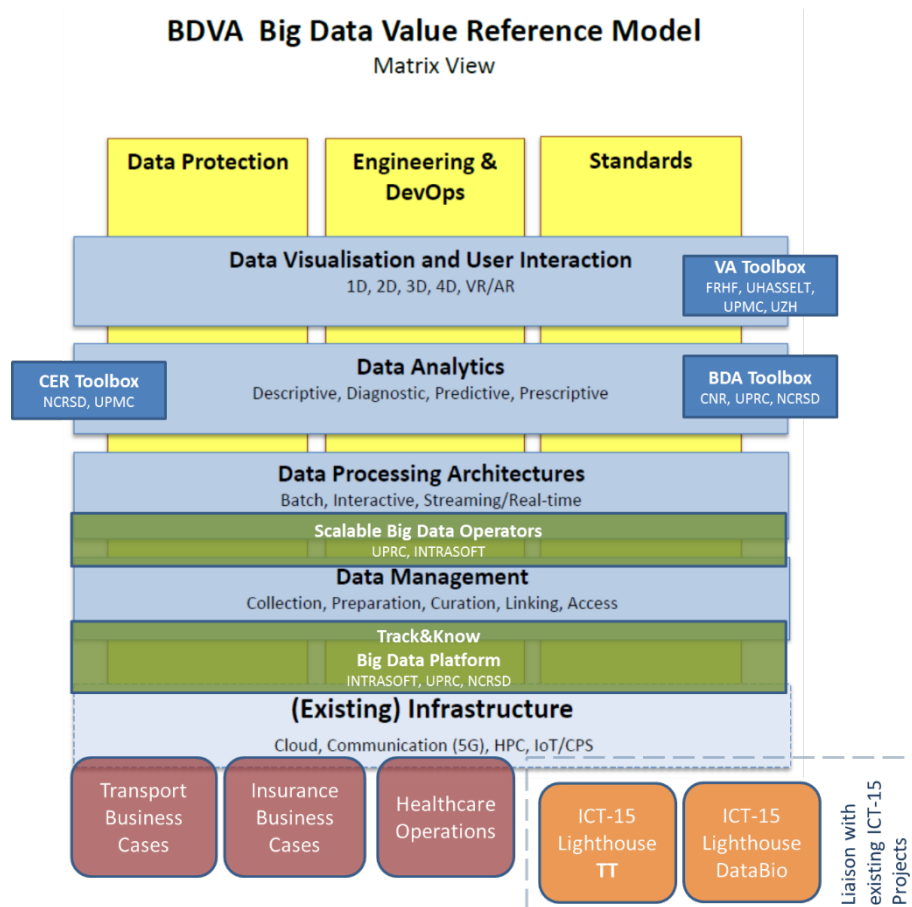

Figure 1: The Track and Know components mapped to the BDVA reference model (source: www.bdva.eu)

2.1 Purpose and scope

The Track and Know project brings together interdisciplinary partners from the transport, insurance, emergency healthcare industries, academia and research along with users and data-provision partners focusing on real-life and user-defined challenges to address the open issues arising from the automotive transportation in modern metropolitan areas and increase the contextual awareness in urban mobility by delivering intelligent information and predictive analytics to user-interest groups, stakeholders and city managers.

Track and Know is a research and innovative collaborative project targeting at developing and exploiting novel technologies and methods in order to increase the efficiency of Big Data domains such as Transport, Insurance and Healthcare, aiming in the same time at the applicability in other European industries. The overall Big Data architecture is shown below (Figure 2).
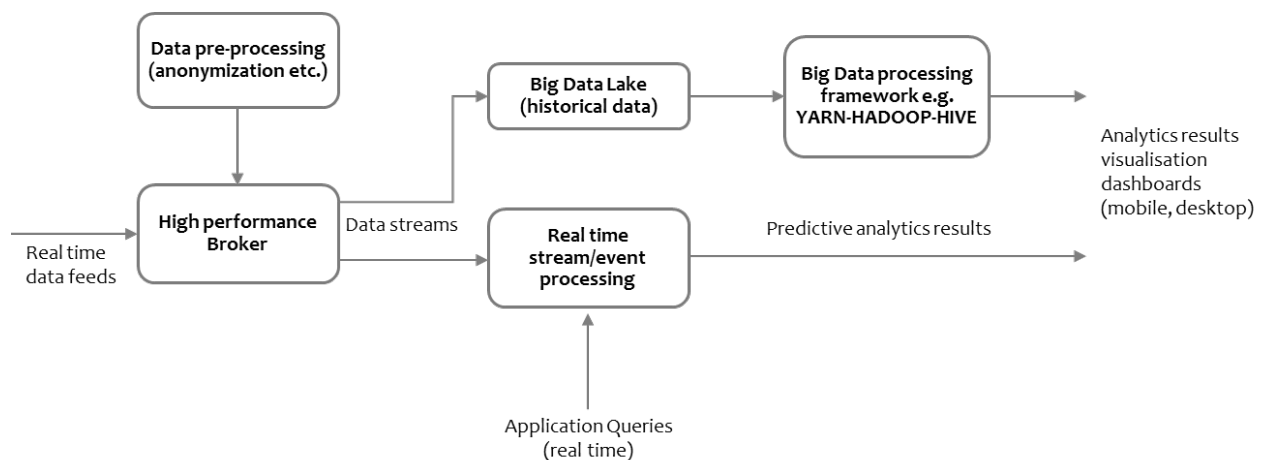
Figure 2: The Track and Know Real Time Processing Flow

The Data Sources are multiple streaming and heterogeneous data sources, as well as archival and contextual data of huge volumes.

Big Data Toolboxes for intelligent and integrated services with predictive safety capabilities (i.e. for collision avoidance, optimized emergency response and/or accident management, driving skills deterioration, adaptable insurance services, etc.) are considered critical by people and researchers within the spectrum to reshape the way that visualization techniques make data accessible in ways humans understand. Advanced data analytics support more efficient decision-making and scalable, iterative processes generate trusted insights in the automotive transportation landscape.

Track and Know incorporated novel methodologies for real-time detection and prediction of individuals and mobility patterns, enabling for risk assessment and crisis management, inference of useful knowledge and complex events related to car drivers, people's transportation activities, together with advanced visual analytics methods, over multiple heterogeneous, voluminous, unlabelled, fluctuating, and noisy data streams, correlating them with archival data exhibiting behavioural and social characteristics, demographics, health and life quality indices, geographical information, mobility analytics and intentional data (e.g. commuting, daily/weekly regularities) etc., in a timely manner. Track and Know applied Big Data driven innovations for Operations and Tasks Planning improvements as well as the configuration of new disruptive business models in the domains of Mobility, Insurance and Health.

More specifically, Track and Know provided a streamlined, Big Data Platform that was endowed with the Big Data frameworks, software stacks and Toolboxes that the project researched, innovated and demonstrated.

The Track and Know Big Data Platform is the hub that was integrated with existing industrial systems that were made available to the project (from Consortium partners, namely INTRASOFT, ZEL, SIS, PAP) and were used within the pilot applications and will be validated during the demonstration cases. Furthermore, the Track and Know Big Data Platform aimed at securing the sustainability of the produced results, engaging the vast spectrum of research and software development communities that participate in the project, and also at engaging global communities of data providers and end users to promote pilot activities not only in the Transport domain, but also to other domains that could benefit by the produced tools. The Big Data Platform was developed by INTRASOFT, a core member within BDVA and is thus aligned with the BDVA reference model (BDV SRIA, 2016), as shown at a high level earlier in Figure 1.

In particular, the BDVA Reference Model covers the most important Big Data technical areas (shown horizontally). The BDVA Reference Model also covers key cross-cutting concerns, such as data protection, cyber security, development and operations, and standards (shown vertically). Track and Know architecture has capitalized on the existing infrastructure that is provided by participating industrial partners in the corresponding demonstration Pilots.

The Track and Know Big Data Platform integrated the components and Toolboxes developed during the project. The design of the proposed developments is based on the BDVA reference architecture and the respective guidelines aim at supporting Big Data application developers at improving their applications performance and efficiency.
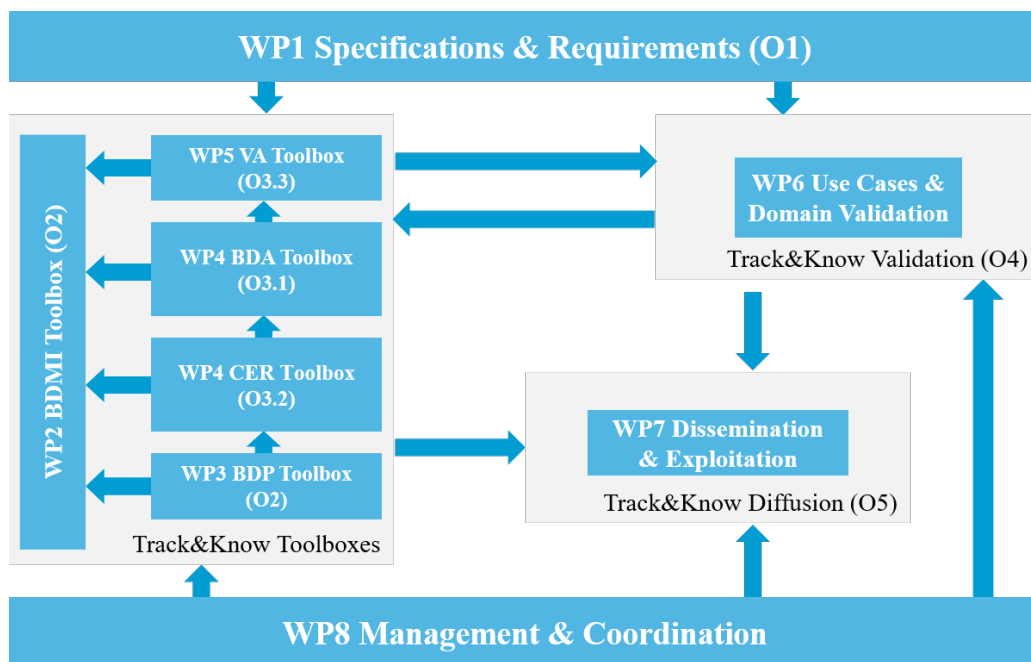
Figure 3: The Track and Know Work plan rationale
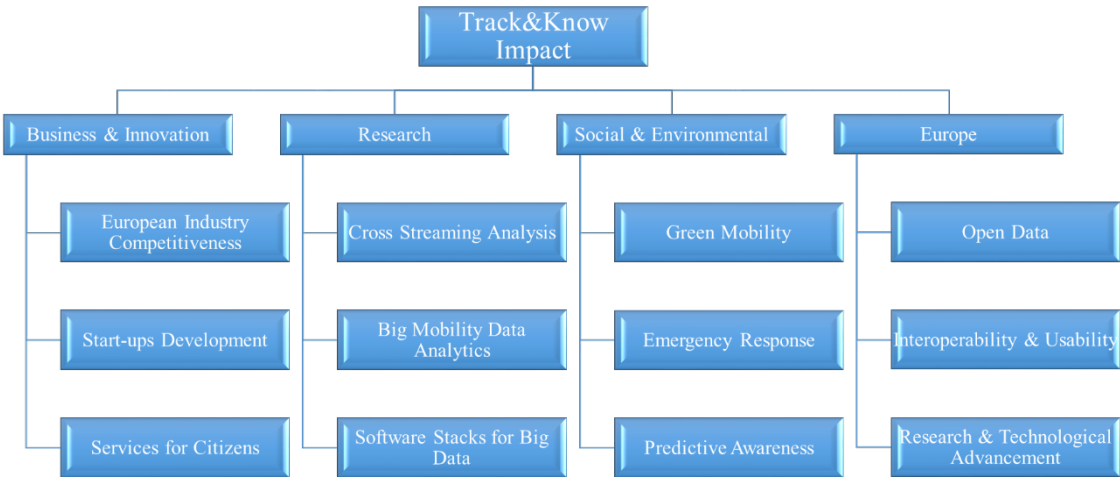
Figure 4: The Track and Know Impacts overview

3 Rules for disseminating publishable output and communicating about the project

The binding rules and procedures applicable for dissemination of results and knowledge generated within the Track and Know project are stipulated in the Consortium Agreement and in the Grant Agreement. Breaches against these obligations may result in the grant being reduced (Article 29 of the GA) or any of the other measures described in chapter 4 of the GA.

3.1 Dissemination and communication activities (Article 29.4)

The following must be included in all dissemination and communication activities:

 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 780754.

3.2 Disclaimer excluding Agency responsibility (Article 29.5)

Any communication or dissemination must indicate:

This publication reflects only the author's view. The European Commission is not responsible for any use that may be made of the information it contains.

4   Project branding

4.1   Project logo

Figure 5: The Track and Know project logo

The project logo is available in the following formats: .ai, .eps, .jpg, .png and .pdf.

4.2   Project colour pallet

The Track and Know colour pallet consists of 2 colours:

- white (RGB 255, 255, 255)
- blue (RGB 48, 117, 183)

4.3   Project logo: usage guidelines

The Track and Know logo should be used correctly at all times.

- There should be sufficient clear space around the logo.
- The logo may not be displayed with a frame.
- Always hold on to the given colour pallet and never switch the logo colours.
- Never use the logo on similarly-coloured backgrounds.
- Never rearrange elements of the design.
- Never stretch or distort the logo.
- Never alter or add elements to the logo.

5   Communication and dissemination plan

In working out this plan, we took into account the different definitions for 'communication' and 'dissemination' in H2020. Communication is defined as "taking strategic and targeted measures for promoting the action itself and its results for a multitude of audiences, including media and public, and possibly engaging in a two-way exchange". Dissemination is defined as "the public disclosure of the results by and appropriate means including by scientific publications in any medium". Hence, communication focuses on both the project and the results. It aims to reach multiple audiences beyond the project's own community (including the media and the public). The goal is to inform and reach out to society, to show the benefits and social relevance of the research. Dissemination is focused only on results and aims to reach audiences that actually use the results such as the scientific community, industry and other commercial actors, professional organizations and policy makers. In other words, dissemination enables the use and uptake of results. It is necessary to make the generated knowledge & results available to our target groups and society in general. Dissemination activities serve as an important source of useful stakeholder feedback, which can be used for optimization.

The following messages & issues were disseminated:

- Current project developments
- Current status of project pilots
- Achieved results
- Achieved milestones
- Published deliverables & other publications (articles, papers)
- Attended events
- Own events
- Other important news

Keeping those definitions in mind, we have identified **seven target groups**, incorporating both audiences interested in using the project results as well as the wider audience. The target audiences are described in chapter 6, the objectives per audience are summarized in chapter 7. Each group is targeted via several media and activities with a specific planned frequency throughout the course of the project. Impact and effect of this strategy was continuously monitored throughout the project. When necessary, the strategy was adjusted.

For each target audience, we will **define goals via the knowledge-attitude-behaviour** approach:

	Strategy
Knowledge *What does the target audience need to know about the process/realisations?*	• Provide information • Eliminate knowledge shortages • Refute incorrect knowledge
Attitude *What attitude do we want the target audience to have towards the process/realisations?*	• Reinforce positive feelings • Weaken (possible) negative feelings • Emphasize desired behaviour
Behaviour *What is the desired behaviour we expect from the target audience?*	• Gain experience with the process/realisations • Remove obstacles (e.g. budgetary, operational) • Provide contextual support (e.g. cooperation of employer)

Table 2: Knowledge-attitude-behaviour approach

The results of this exercise are described in chapter 6 of this deliverable.

As a starting point for this CDP we used the below figure (Fig. 4) which originated from the following 5 questions. Upon these questions, we have built a CDP which fits the Track and Know project, its goals and its purpose. One by one, we will answer these questions and put the strategy into practice.

1. What is the product about, what is the relevance to the public and what are its USP's?
2. Who do we want to reach?
3. Which media do we use (owned, paid, earned) and do they fit our message and our audience?
4. How are we going to communicate and multiply our content, disseminate our project results? Which products and activities will be used?
5. How are we going to monitor and improve our communication and dissemination efforts constantly in order to reach our goals?
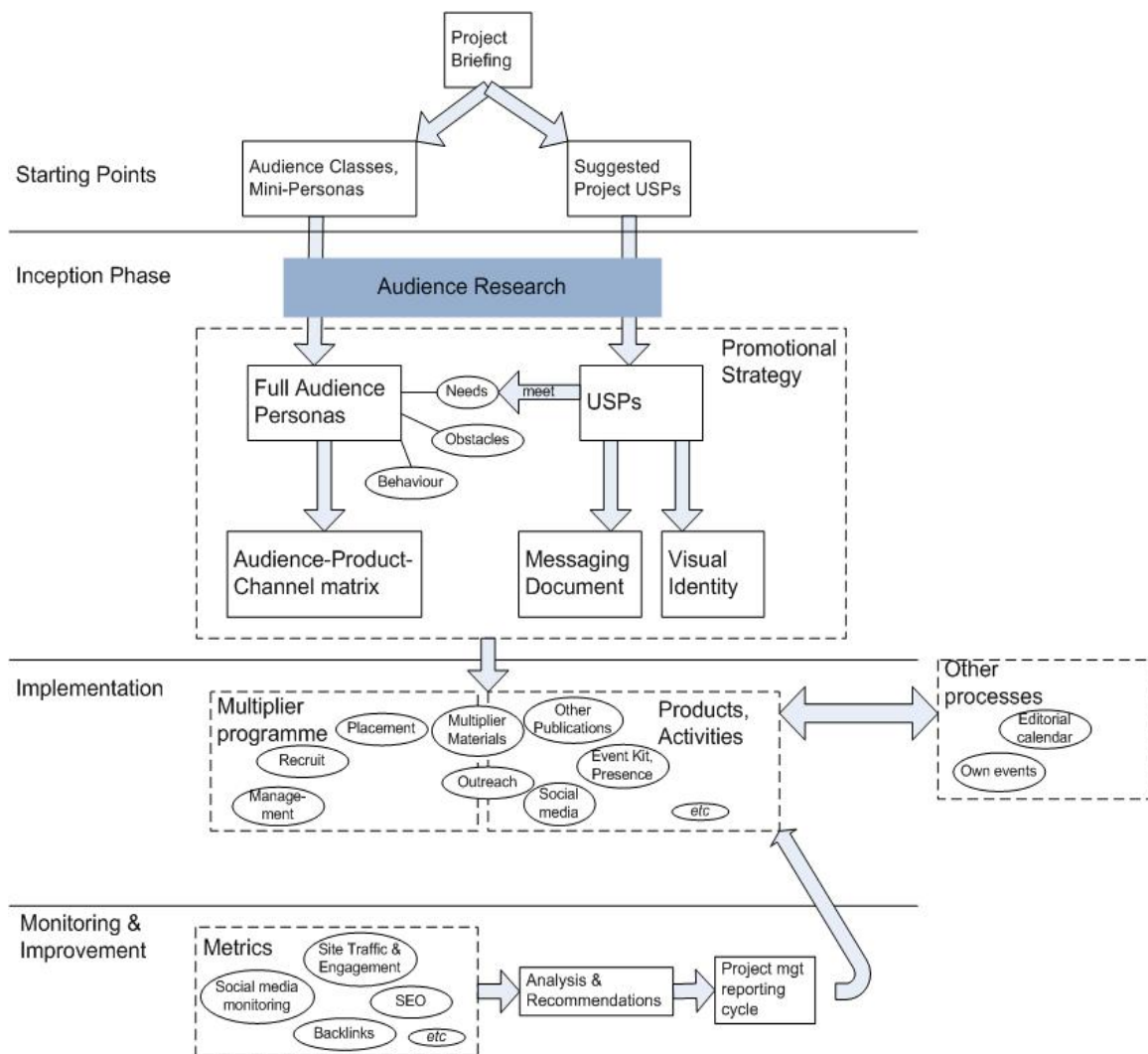

Figure 6: The Track and Know Communication strategy

6 Stakeholder target groups

Track and Know identified **seven target groups** relevant to the project. These target groups range from highly specialized decision makers with a good knowledge of the topic through decision makers on different levels and practitioners who will make practical use of the results to the general public.

Within these target groups, we distinguish **three types of target audiences**. Primary audiences are groups who are most affected by the action or for whom the action has the greatest impact. In other words, stakeholders who experience immediate effect of the process/realizations, being the Track and Know team and the scientific community. Secondary audiences are those who are informed about the process, but they are not directly involved and do not experience an immediate effect. However, this can change in the future, for example when results get implemented in hospitals or fleet management. They can then become primary groups: public, commission, policy makers, industry. Intermediary audiences are stakeholders with a mediating role which help to distribute information on the process and the results: civil society and media.

Audience Type	Audience Group	Audience members
PRIMARY	Track and Know team	Researchers, supporting staff
	Scientific community	Research community, academic community
SECONDARY	General public	Concerned citizens
	Commission	EU, INEA
	Policy makers & industry (interested, specialised and highly specialised)	Local related politicians and & their civil servants
		Regional/national politicians and & their civil servants
		Local business leaders
		Local mobility politicians
		Transport & research leaders
		Local mobility civil servants ICT Experts Managers Transport Hub Managers Investors
INTERMEDIARY	Civil society	NGO's, user organisations, etc
	Media	national press of the countries that are involved in the project

Table 3: Target audiences

6.1   Track and Know team

Firstly, the Track and Know team consists of the researchers and supporting staff of the following 14 consortium partners from 8 different European countries:

- Inlecom Group BVBA – Belgium (INLECOM)
- Cambridge Medical Academy Ltd. – United Kingdom (CEL)
- Consiglio Nazionale Delle Ricerche – Italy (CNR)
- Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V. – Germany (Fraunhofer)
- Intrasoft International SA – Luxembourg (INTRASOFT)
- Konnekt-able Technologies Limited – Ireland (KT)
- National Center for Scientific Research "Demokritos" – Greece (NCSRD)
- NHS Royal Papworth Hospital – United Kingdom (PAPWORTH)
- SISTEMATICA – Italy (SIS)
- Hasselt University, Transportation Research Institute – Belgium (UHASSELT)
- Sorbonne Université – France (UPMC)
- University of Piraeus Research Center – Greece (UPRC)
- Universitaet Zuerich – Switzerland (UZH)
- Vodafone Innovus – Greece (ZEL)

Important to ensure a smooth project progress is a consortium of partners and people in which everybody is aware of the expectations within the project. Knowing the rules and the deadlines, being aware of the responsibilities, staying up-to-date about the projects' direction, achievements, planning and targets … is imperative to ensure success.

Within this consortium, a communication and dissemination focus group was formed which advised on local, national and international related media that could be useful to communicate and disseminate about the Track and Know project and its results.
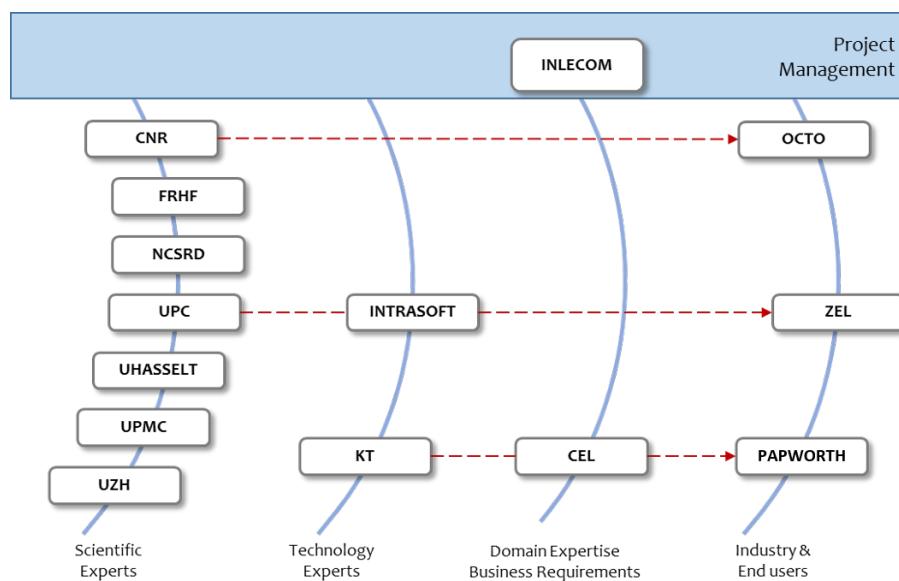

Figure 7: The Track and Know Consortium structure and roles

6.2   Scientific community (primary audience)

Dissemination within the scientific community is a pre-requisite to successfully implement the project. Knowledge exchange is crucial for assessing the state-of-the-art, project planning, evaluation of project results and exploitation of results. Track and Know aims to create interest for relevant research work with the research community by sharing information about the project's methodological multidisciplinary approach in order to develop a new software framework that aims at increasing the efficiency of Big Data applications in the transport, mobility, motor insurance and health sectors. This framework enabled the Track and Know team to develop user friendly toolboxes that are readily applicable in the addressed markets, and additional domains, proving its high relevance to contemporary and future society.

6.3   General public (secondary audience)

The general public refers to all individual members of society. People are generally interested in what directly affects them. Ranging from hospital patients who (consciously or unconsciously) experience the importance of good, effective data management in the health sector, to people showing an interest in insurances and how they manage data about car accidents or health issues. It is therefore imperative that communication about project's objectives and results is communicated in a way that the general public can understand it, gets interested and becomes aware of the added personal value for them.

Our goal is to convince individual members of the public of the added value of this research and the software framework that will enable efficient Big Data management in the health sector, insurances, transport sector and many other sectors that affect the daily life of the general public. It is of the highest importance to make the general public aware of the scope and impact of Big Data management on their everyday life as the use and processing of Big Data most often remains invisible and unnoticed to the general public.

6.4   Commission (secondary audience)

Throughout the course of the project, the EU / INEA is an important communication stakeholder. It is necessary that the consortium keeps them informed at all times about project progress, possible implementation challenges, status of contract obligations and the administration of the EU's financial contribution.

6.5   Policy makers and industry (secondary audience)

When defining the policy makers as a target group, we refer to local authorities, as well as regional, national and EU level. Several communication activities will aim to reach this specific target group which involves local/regional/national/international related politicians and & their civil servants, mobility politicians, etc.

'Industry' is the denominator we use for the public health sector, the vehicle industry, public and private transport companies (like De Lijn, NMBS...), insurance companies (e.g. Ethias, AG Insurance...), fleet management companies. These industries are the subject of the Track and Know case studies. But also many other industries will benefit from the results of the Track and Know research in the future since Big Data is inherent to contemporary industries of all kinds. Local/regional/national/international business leaders, transport and research leaders, ICT expert managers, transport hub managers, investors, etc.

6.6   Civil society (intermediary audience)

By 'civil society' we mean NGO's and user organisations (e.g.). They are very active in influencing policy formulation as they generate important impulses for the progress in Big Data management and contribute to setting the agenda in the member states as well as on the European level.

The contacts that each individual project partner has with these stakeholder associations were used to create partnerships to maximize the promotion and dissemination of the results and recommendations issued in the framework of the project.

6.7   Media (intermediary audience)

Under the denominator 'media' we considered the national press of the countries involved in the project. It is an important target group, since much of the information provided about the goals, relevance, methods and results will pass a national medium to reach one or more of the other target groups described above. All project partners identified relevant national press contacts. When necessary, press distribution lists were updated and/or expanded during the course of the project.

Relevant media are (daily) newspapers, national specialist publications but also political press at European level like 'New Europe' or 'EUobserver'.

6.8   Which specific stakeholders have we reached out to and what is their relation to the system?

System provider	Service provider	System user	System payer	System influencer
Software developer	Vodafone Innovus	Insurance company	IsurTech company	Government department
Intergrator		Insurance actuary	E-mobility Service Providers	Electric car manufacturer
		e-Mobility clearing house	Electric Charging Service Providers	Policy maker
		e-Mobility service provider	E-mobility Service Providers	Medical thought leaders
		Electric car manufacturer	Electric Charging Service Providers	professional organisations
		Carpooling company	Carpooling Company	OSA ecosystems
		OSA service providers	Dept. for Health	patient organisations
		OSA patients	Clinical Commissioning Groups	driving regulatory bodies
		GP surgeries	Private medical companies	Big Data researchers
		External clinicians / OSA researchers	Insurance companies	IoT marketing and business vision
		Result commercialisers	Charities	The European Commission
		Training providers		The General Public
		Equipment manufacturers		Local government
		Fleet manager		National politicians
		Fleet management software developers		Local (transport) business leaders
		R&D commercialisers		Local mobility politicians

		Members of the public		Transport & research leaders
				Local mobility civil servants
				ICT experts managers
				Transport Hub Managers
				Investors

Table 4: Stakeholder details

7 Stakeholder engagement goals

Audience type	Target Audience (TA)	What does the TA (need to) know about the process / realisation? (KNOWLEDGE)	What is the TA's desired attitude towards the process / realisation? (ATTITUDE)	What is the TA's desired behaviour towards the process / realisation? (BEHAVIOUR)
Primary	**Track and Know team** *(researchers and supporting staff of the 14 consortium partners)*	1. What is my role in the project and what is the role of other consortium members? 2. What is expected from me and what are my deadlines? 3. Where can I find all the relevant material to carry out my work? 4. How can I contact other consortium members?	The Track and Know team is motivated to execute the project in accordance with the H2020 rules described in the Grant Agreement (GA) and the different Annexes of the GA.	The Track and Know team carries out the tasks and responsibilities attributed to them as described in the GA and the different Annexes of the GA.
	Scientific community *(other researchers, scientific experts, academic community)*	1. What progress can be made? 2. Where can we learn more about project methods and results? 3. How can we use the project methods/results?	1. The scientific community wants to know more about our methodological approach and the software framework we make available. 2. The scientific community follows up on the pilot cases. 3. The scientific community wants to contribute to our approach.	1. The scientific community (e.g. individual researchers) follows us on social media and registers for our newsletter. 2. The scientific community (e.g. other projects) forms partnerships with us. 3. The scientific community reads /consults our project output (reports, publications, datasets…)

			4. The scientific community wants to pick up where we have left and wants to book further progress with our material.	4. The scientific community invites us to present our research methods and results. 5. The scientific community collaborates with us.
Secondary	**Public** *(interested and general public, from parents worried about their kids' safety as they cycle to school, to environmental activists)*	1. What is the research about? 2. How can the research results be relevant and useful in our everyday lives?	The individual road user is interested in the system we are developing and wants to know more about it.	1. Individual road users follow us on social media and register for our newsletter. 2. Individual road users want to use the system we develop because they are convinced of the added personal value.
	Commission *(EU / INEA)*	1. What progress is made? 2. Are all the goals met? 3. Are all the deliverables submitted in time and of sufficient quality? 4. Are all the milestones reached? 5. Is the budget being spent correctly?	EU / INEA is satisfied with our project progress, our approach, our management, our expenditure and the deliverables we submit.	1. EU / INEA approves our deliverables. 2. EU / INEA approves our submitted costs. 3. EU / INEA proceeds with payments according to the costs submitted and the stipulations in the GA.

	Industry & policy makers *(Local related politicians and & their civil servants, Regional/national politicians and & their civil servants, Local business leaders, Local mobility politicians, Transport & research leaders, Local mobility civil servants, ICT Experts Managers, Transport Hub Managers, investors, decision makers in health sector, insurances & transport)*	1. Is the research focussing on the correct research questions/needs? 2. How can we use the results to improve products, processes, productivity, quality…?	1. Industry understands the added value of our work for their business 2. Industry wants to contribute their input to make sure we can serve their needs better. 3. Industry wants to use our project results.	1. Industry representatives follow us on social media and register for our newsletter. 2. Industry representatives participate in our User Advisory Board. 3. Industry uses our system to improve behaviour and safety of all travellers and all modes. 4. Industry takes up our recommendations on ICT infrastructure and tools for better travellers' connectivity and interaction with the system and devices.
	(local, regional, national and EU level)	3. How can the project results facilitate and improve policy decision making regarding Big Data use and processing? 4. How can we use the results?	4. Policy makers understand the added value of our work for policy decision making. 5. Policy makers want to contribute their input to make sure we can serve their needs better. 6. Policy makers want to use our project results.	5. Policy makers (from different levels) follow us on social media and register for our newsletter. 6. Policy makers (from different levels) get an insight in the software framework we develop and its areas of application.

| Intermediary | Civil society

(NGO's, user groups, training centres) | 1. How can the project results impact society and its (big) data processes?

2. How and when will the project results be implemented? | 1. Stakeholder associations understand the added value of our work for big data processes in several sectors and industries

2. Stakeholder associations want to know more about the progress we make.

3. Stakeholder associations want to help promote our project communication. | 1. Stakeholder associations follow us on social media and register for our newsletter.

2. Stakeholder associations actively share our social media posts or publish articles about Track and Know in their own media (e.g. websites, newsletters, journals, brochures).

3. Stakeholder associations provide us a forum to communicate about Track and Know during their own events. |
|---|---|---|---|---|
| | Media

(national general press, national specialist press, political press) | 1. What is the research about?

2. How can the research (results) be relevant and useful in people's everyday lives?

3. What is new, innovative, relevant … thus newsworthy … to dedicate an article, radio or tv item to it? | 1. Journalists feel that the project objectives and results are useful in people's everyday lives.

2. Journalists feel that our communication is newsworthy enough to dedicate an article, radio or tv item to it. | 1. Journalists follow us on social media and register for our newsletter.

2. Journalists dedicate articles, radio or tv items to Track and Know on a regular basis (e.g. when they receive status updates via press releases). |

Table 5: Stakeholder engagement goals

8 Dissemination and communication objectives

The Track and Know – project focuses on **five main objectives, including dissemination and communication**:

Objective 1

Create the Track and Know framework of best practices, technology implementation patterns and toolsets. This framework will map the end user industry analytics needs and corresponding datasets in transportation, health and insurance to the BDVA reference model.

Objective 2

Produce a scalable, fault-tolerant platform for Big Data by collecting, integrating and processing streams of data.

Build efficient, interoperable and scalable Track and Know Toolboxes with Big Data Software stacks and integrate them into the Big Mobility Data Integrator.

Create toolsets for efficient distributed management, process mining querying and the visualisation of Big Data (Big Data Processing Toolbox or BDP Toolbox)

Objective 3

Produce the Track and Know analytics toolboxes. These toolboxes include the real-time detection and forecasting of the Big Mobility Data Analytics Toolbox and the Predictive Complex Event Recognition Toolbox

Produce the Track and Know Analytics Toolboxes:

- The real-time detection and forecasting of Big Mobility Data Analytics (BDA) Toolbox;
- The Predictive Complex Event Recognition (CER) Toolbox;
- And the Real-time Interactive Visual Analytics (VA) Toolbox.

Objective 4

Test, validate and evaluate the Track and Know Toolboxes addressing different industrial domains, such as the automotive mobility, health and insurance.

Objective 5

Ensure scale up through wide dissemination, exploitation actions, liaison, clustering and correlation with other European and large-scale pilots and projects.

To reach the proposed objectives, Big Data Research requires a multi-disciplinary approach. This approach will bring together research actors, customer's demand and business field experts, provisioning infrastructure operators, and software industry actors in order to transform the voluminous and incomprehensible data into intelligence and knowledge.

Because the Big Data penetration is not adequately developed in niche markets outside the traditional ones, the Track and Know Toolboxes will be demonstrated in three real-world pilots. During these pilots, datasets from niche market scenarios will be used to validate efficiency improvements. Also, performance and impact benchmarks are elaborated and will be documented during the pilot's deployment.

9 Dissemination and communication tools and activities

The previously identified target audiences were addressed by a broad range of tools and activities**. The consortium had a shared responsibility for dissemination and communication and was committed to promoting the project's activities, progress and results on a regular basis.**

The selected tools and activities to communicate and disseminate Track and Know news and output are summarized below. They are chosen to reach the various identified target audiences, previously described, as effectively and efficiently as possible taking into account the mentioned target audience goals. They vary from online to offline media, of scientific nature on the one hand to more easy-to-read material on the other hand. But also several types of events and meeting formats are included. **Annex 1 provides a matrix overview of the entire communication and dissemination plan**, showing the different target audiences, tools and activities, responsibilities and availability/frequency of occurrence.
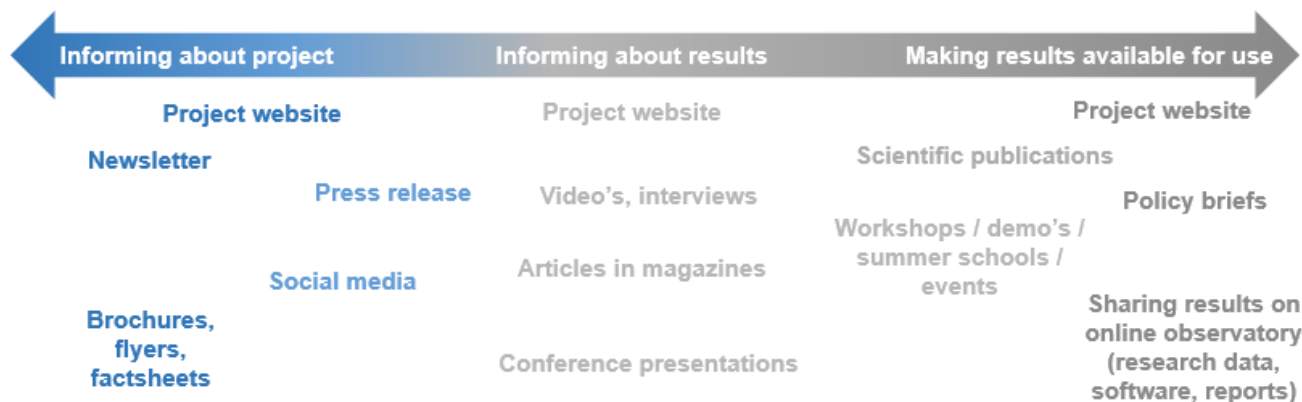
Figure 8: Dissemination and communication tools and activities

9.1 Editorial team

IMOB - UHasselt, member of the consortium and responsible for task 7.1 (dissemination & training) has established an editorial team of four people from the Transportation Research Institute. Two of those employees are masters in communication sciences and are responsible for the communication and marketing activities of IMOB. An IMOB-UHasselt project leader and an IMOB UHasselt researcher both join the editorial team to make sure that a bird's eye perspective on all the project activities is available at all times. The editorial team had weekly meetings. The main tasks include:

- Encouraging the project partners to provide input on their activities;
- Processing and editing this input;
- Publishing the input via one or more communication tools.

The editorial team decided which information was relevant to which channel (e.g. website, newsletter, social media post, press release…) and took care of further actions and realizations.

The editorial team imposed on all the project partners a responsibility to inform the editorial team about all developments and available results and to help promote Track and Know news according to the tips and instructions provided by the editorial team.

9.2 Mailing lists

To communicate as efficiently as possible within the consortium, we tried to avoid spamming as much as possible by mailing exclusively to people to whom the message is relevant. To be able to do so, 12 mailing lists were set

up. For work packages 1 to 7, separate mailing lists (trackandknow-wpx@uhasselt.be) were created to efficiently communicate about a work package to the researchers involved.

Other mailing lists:

- Trackandknow-ab@uhasselt.be can be used to email the advisory board.
- trackandknow-management@uhasselt.be can be used to email all project managers.
- trackandknow-pmb@uhasselt.be can be used to email the project management board.
- trackandknow-all@uhasselt.be exists to use in cases when we need to communicate to everybody (researchers as well as supporting staff) involved in Track and Know, for example to prepare a mid-term review.
- Trackandknow-newsletter@uhasselt.be can be used to send out the newsletter to registered contacts

Audiences targeted	Track and Know team
Availability / frequency	Mailing lists available as of January 2018 (M1).
Who is responsible?	The editorial team has set up the mailing lists and the project partners are required to use them.

9.3 Website

The project website, www.trackandknowproject.eu, was launched in January 2018 and will remain online up to five years after the project end date (December 2025). The website is designed, hosted and maintained by IMOB-UHasselt and serves as the central medium containing up-to-date project information at all times. In June 2019, the website got a thorough update, a fresh look and feel and some new features including a user-friendly online observatory. In December 2020, the website will be updated again, with a clear focus on showcasing and disseminating the project's results.

The website provides general information about Track and Know, its aims and output, project updates and information about the consortium partners. Documents such as public deliverables, (open access) publications and newsletters are published online. An up-to-date calendar providing an overview of upcoming project events and activities, as well as links to related projects and networks can be found on the website. A news section is integrated in the site to inform visitors about relevant news and ongoing developments. These news items can be easily shared on Facebook, Twitter and LinkedIn by clicking one of the buttons on the left.

In maintaining the website, special attention goes out to SEO (Search Engine Optimization). This means that the content of the website is optimized continuously based on the most frequently used keywords. To obtain a good insight into the most frequently used keywords, the number of (unique) visitors, when the website is visited the most and the way those visitors land on the website, Google Analytics is used. We will elaborate on the monitoring of the results in chapter 11. Several screenshots of the website are depicted in Annex 2.

The project website also includes an **online observatory** which provides Track and Know datasets, relevant literature and research papers and (near the end of the project) Track and Know software. This content is provided in an easy-to-use folder structure and was updated and complemented on a regular base.

Audiences targeted	Track and Know team, scientific community, general/interested public, policy makers, industry, commission, civil society, media

Availability / frequency	The website is available as of January 2018
	Hasselt University maintains and updates the website at least bi-weekly and strives for at least 800 unique visitors per year with at least 1/3 spending more than 2 minutes on the site
Who is responsible?	The editorial team sets up and manages the website.

9.4 Triptych flyer

The triptych flyer is a project leaflet outlining the scope, goals and team of Track and Know. It was designed and written in English in June 2019 and made available in printable PDF form to all the consortium partners and downloadable on the project website. The aim of the flyer was to give interested parties a quick insight in Track and Know, its goals and approach. The flyer was available in print (500 flyers) and we also offered a PDF file for print by each partner for their own use. It served as promotional material to be used at external dissemination activities or to hand out to any of the target audiences to get acquainted with Track and Know in order to enhance collaboration. The leaflet is depicted in Annex 3.

Audiences targeted	scientific community, policy makers, industry, civil society
Availability / frequency	Available as printable/downloadable PDF as of June 2019 (M18) + 500 printed flyers.
Who is responsible?	The editorial team realizes the flyer, to be distributed by the project partners.

9.5 Templates/Project identity manual

As already stipulated in the first paragraph of chapter 6, the consortium had a shared responsibility regarding communication and dissemination activities. To make sure the correct visual identity is used in all our output by everyone involved in Track and Know, the following **templates** have been worked out and made available for the entire consortium:

- Template for deliverable reports
- Template for meeting minutes
- Template for periodic review report
- Template for PowerPoint presentations
- Template for newsletters
- Template for registration lists for events

Each template contains the project logo, the EU emblem and the correct reference to the funding agency.

Audiences targeted	Track and Know team
Availability / frequency	Templates available as of January 2018
Who is responsible?	The editorial team set up the templates and the project partners were required to use them and not use any other formats.

9.6 Brochure

The project brochure is a small booklet describing the main project results and application possibilities. The booklet will be designed in English will be made available in printable PDF form to all the consortium members and available for download on the project website. It serves as an important promotional material to be used in exploitation activities.

Audiences targeted	scientific community, policy makers, industry, civil society
Availability / frequency	Available as printable/downloadable PDF on the project website at the end of the project (M36).
Who is responsible?	The editorial team realizes the brochure, based on input of the project partners. To be distributed by the project partners focusing on further exploitation activities.

9.7 Video

Track and Know produced an explainer video about the project and published it on the Track and Know YouTube channel. The video is also available on the landing page of the website.

An explainer video is a short (animated) video that focuses on explaining an idea, product or concept in a simple, engaging and compelling way, by using a clear and concise language and appealing and attractive visuals that quickly grab (and hold) the viewer's attention. Explainer videos have become very popular. Some sites see conversion rates increase by as much as 144% after including an explainer video.

The video explained the main project goals and application possibilities and was used to engage stakeholders. Views were boosted through promotional actions via social media, newsletters, press releases …

Furthermore, Track and Know added several other videos to the project's YouTube channel, explaining specific project results like NoDA, the Data cleaning and enrichment pipeline and the Big Data Integration Platform. All of these videos can be found in a playlist in the Track and Know YouTube channel.

This YouTube channel also offers recordings of Track and Know webinars and conference presentations, like the Big Data Pilot Demo Days webinars and the final event during the EBDVF 2020 conference, which will be further discussed later on in this document. The videos are organized in several playlists, to enable the user to quickly navigate towards the wanted video content.
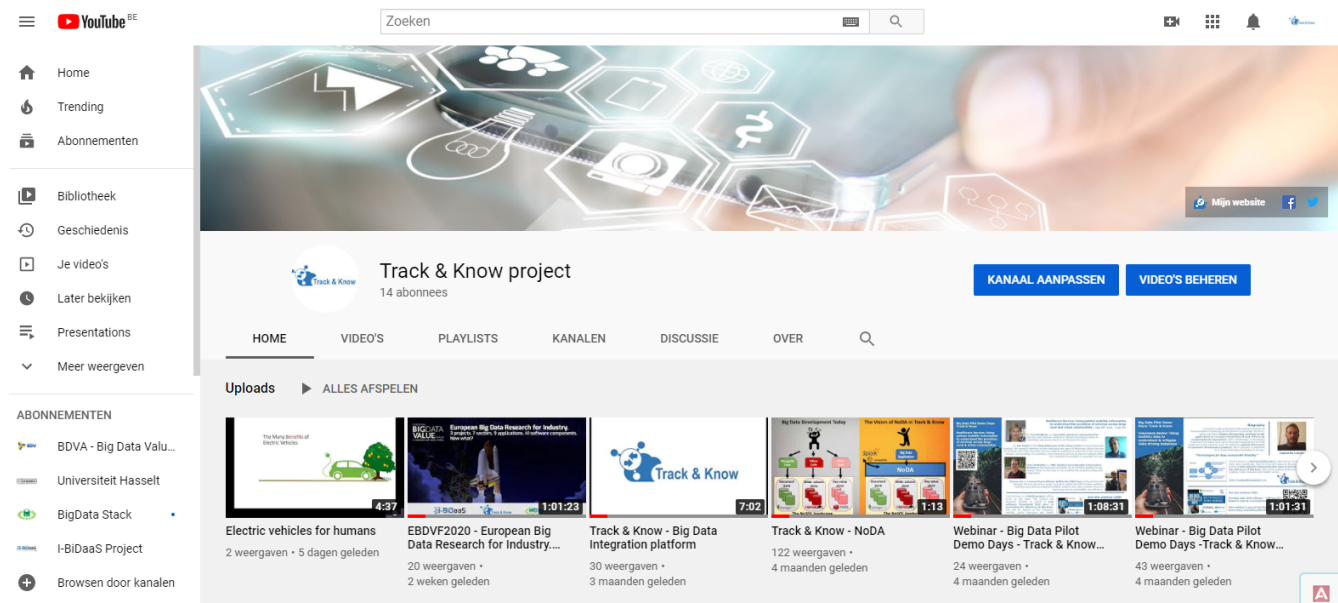
Figure 9: Screenshot of the Track and Know YouTube channel

Audiences targeted	Track and Know team, scientific community, general/interested public, policy makers, industry, commission, civil society, media
Availability / frequency	The video was released in December 2019 (M24) and aims for at least 4000 views via the project website, the project's YouTube channel and social media channels
Who is responsible?	The editorial team worked out the final storyline for the explainer video, integrating feedback of project partners. Realization was done using Biteable.com, an online video editor, by IMOB-UHasselt. All partners were involved in creating additional videos including webinar recordings, etc. The YouTube channel was managed by IMOB-UHasselt.

9.8   Newsletters

At least twice a year, a newsletter was sent to the project team and a list of stakeholders that had registered for the newsletter. We chose to work this way (opt-in via online registration on the Track and Know website with the possibility to opt-out) to assure compliance with the General Data Protection Regulation (GDPR) that entered into force on 25 May 2018. All the project partners encouraged their own contacts to register for the newsletter. Newsletters were also published in PDF on the project website on a dedicated webpage and promoted in a news item. Each new issue was promoted via our project's social media channels, to boost new registrations.

Articles in newsletters covered achieved milestones, recent results, new developments, planned activities and events and published project output. Content setting started three months before the publication of a newsletter. The content was provided by the project partners via the WP leaders. The editorial team edited the input to make sure that all the articles were written in a comprehensive language. Editing was carried out in close collaboration with the WP leaders, to make sure nothing got lost in translation.

The first newsletter was sent in April 2019 covering news and developments, carried out in the first 16 months of the project. To send out the newsletter, we used mailing lists, as mentioned above in paragraph 9.2, that were

managed in Mailchimp. The eighth and final issue of the newsletter will be sent out at the end of the project, presenting the project results and plans for the future. For issue 1 up to 7 of the newsletter, please see Annex 4.

Date	Publication
Apr-19	Issue 1
Apr-19	Issue 2
Jun-19	Issue 3
Oct-20	Issue 4
Feb-20	Issue 5
May-20	Issue 6
Sep-20	Issue 7
Jan-21	Issue 8

Table 6: Overview project newsletters

Audiences targeted	Track and Know team, scientific community, general/interested public, policy makers, industry, commission, civil society, media
Availability / frequency	Issues appeared at least every 6 months leading up to 8 issues in total. The aim is to reach 4000 stakeholders via the online distribution and the project website.
Who is responsible?	The editorial team realized the newsletters, based on input of the project partners. Distribution via email was carried out by the editorial team to a list of registered people. The newsletter was also available on the project website.

9.9 Popular articles

Opportunities for articles in popular magazines (often more locally oriented) like e.g. a university/organization magazine, stakeholder newsletter, annual report… were actively pursued by each consortium partner. They are a great way to inform their own network about project status, innovative methods, interesting results … When input was obtained from the project leaders, the editorial team worked out popular articles in accessible English. These articles could be locally translated by other consortium partners in their own national language, to increase chances for being accepted in local, popular media. For examples and an overview of the published popular articles, please see Annex 5

Audiences targeted	scientific community, interested public, policy makers, industry, civil society
Availability / frequency	The goal was to appear at least 5 times in popular and local media, about once a year
Who is responsible?	Realized by the editorial team in English, based on input of the project partners. To be translated in national languages by project partners.

9.10 Social media

The power of social media is a proven fact by now. These channels can help us share valuable project information with interested groups and people … and this way forming, as it were, a Track and Know community. By interacting with like-minded and interested contacts, we were able to create buzz about the project, form a community and thus facilitating exploitation activities.

We have chosen to work with three social media to fulfil several target audience goals. For all three media, news posts of the website could be shared via personal Facebook, Twitter and LinkedIn accounts. To facilitate and encourage the distribution of news items on the project website, social buttons were added to the website. It only took one click to share a news item via Facebook, Twitter or LinkedIn. For screenshots of the mentioned social media accounts, please see Annex 6.

9.10.1 Facebook

Facebook focuses mainly on individuals connecting with friends and family through their pages in order to stay connected and interact easily and regularly. Not only offered the Track and Know Facebook page an opportunity to easily group our consortium members' individual contacts, it was also a convenient medium to use when specific audiences needed to be targeted. For example, to recruit respondents for a stakeholder survey. By using (paid) Facebook Adds, we could specifically target relevant stakeholders and invite them to complete the survey with paid ads.

URL Track and Know Facebook page: https://www.facebook.com/Track-Know-890819961261327/

Audiences targeted	Track and Know team, scientific community, interested public, policy makers, industry, commission, civil society
Availability / frequency	The goal was to reach at least 1000 followers (on Facebook, Twitter and LinkedIn combined) by the end of the project with regular posts.
Who is responsible?	Supervised by the editorial team and actively supported by the project partners.

9.10.2 LinkedIn

LinkedIn Groups are hubs on LinkedIn that provide a place for professionals in the same field or with similar interests to share content, find answers, grow their professional network and establish themselves as experts. Hence we have created a Track and Know LinkedIn Group. To form a group of like-minded contacts, we counted on the effort of the entire consortium to encourage their own contacts to join the group. The editorial team of IMOB-UHasselt carried the main responsibility for delivering group content and keeping the group alive. However, partners had the right and obligation to join, share and contribute to group discussions and information updates.

URL Track and Know LinkedIn group: https://www.linkedin.com/groups/12122105/

Audiences targeted	Track and Know team, scientific community, interested public, policy makers, industry, commission, civil society

Availability / frequency	The goal was to reach at least 1000 followers (on Facebook, Twitter and LinkedIn combined) by the end of the project with regular posts.
Who is responsible?	Supervised by the editorial team and supported by the project partners.

9.10.3 Twitter

Whereas Facebook networks people, Twitter networks ideas and topics. Twitter focuses on quick, real-time information allowing people to use hashtags to easily connect ideas and topics. This makes searching for a topic very simple. It is also very popular in the scientific community. Those are the most important reasons for setting up a Track and Know Twitter account. It makes it easy to connect to people and organizations actively following up on topics like Big Data, Data processing, …

Track and Know Twitter account: @TrackandKnow

Audiences targeted	Track and Know team, scientific community, interested public, policy makers, industry, commission, civil society
Availability / frequency	The goal was to reach at least 1000 followers (on Facebook, Twitter and LinkedIn combined) by the end of the project with regular posts.
Who is responsible?	Supervised by the editorial team and supported by the project partners.

9.11 Press releases

In order to get broad attention for achieved results, reached milestones or relevant events, we worked out concept articles (press releases) for news media. The overall goal was a total of 6 press releases throughout the project. The editorial team of IMOB-UHasselt prepared drafts of press releases in English and handed them over to each consortium partner, who translated them into their national language. Each partner had the right to tailor the press release to their own role in the project, in order to increase changes for media take-up. Press releases were simultaneously launched to the national press networks of each participating country. For examples of press releases, please see Annex 7.

Date	Title	Language
Jul-18	EU project T&K increases the efficiency of Big Data applications in transport, mobility, motor insurance and health sectors.	English, Dutch
Jun-19	Track & Know reaches mid-term and engages in important liaison activities	English, Dutch
Jul-19	EU Horizon 2020 project Track & Know project reaches halfway	English, Dutch
Nov-19	Track & Know research project investigates how Big Data analysis can help prevent traffic accidents due to obstructive sleep apnoea	English, Dutch
Dec-20	Track & Know final event: report joint session released	English
Dec-20	Track & Know: end of the project	English

Table 7: Overview press releases

Audiences targeted	media

Availability / frequency	At least 3 with an aim for 6 in total throughout the project.
Who is responsible?	Prepared by the editorial team in English and translated in local language and personalized by project partners. Distribution via press network of each partner.

9.12 Deliverables

Intermediate progress output is reported via 31 deliverables that will be made available on the Track and Know website. Online publication however is under embargo when there are scientific publication opportunities and always depends on the permission from the commission. 18 deliverables will be made available for the consortium and the commission only. The total set of 31 deliverables include the mid-term review report and the final review report.

Audiences targeted	scientific community, interested public, policy makers, industry, commission, civil society
Availability / frequency	Timing is visualized in a Gantt chart (see Annex 8)
Who is responsible?	Realized by the lead partner, responsible for each deliverable.

9.13 Journal papers

Track and Know partners will publish articles in scientific journals. Those articles will be written by researchers from partner institutions directly involved in project experiments and studies. Publishing will comply with Open Access requirements in Horizon 2020. Open Access publications will also be published on the project website and in the Continuous Reporting Module of SyGMa. For an overview of the published papers, see Annex 13.

Audiences targeted	Track and Know team, scientific community, commission
Availability / frequency	At least 12 with Open Access standards during the project duration as of M12
Who is responsible?	Realized by the project partners.

9.14 Proceeding papers/presentations

The project partners took part in different events, such as conferences or workshops. They reported on Track and Know research and introduced the project in general. The aim was to disseminate project results on national as well as international level. The process of identifying the most relevant conferences and other events was an ongoing process. Decisions on attendances were taken during the monthly WP leader telco meetings and based on the scope of the event, the project budget, responsibilities and availability of researchers.

Publications in conference proceedings linked to the aforementioned events, written by consortium team members also complied with Open Access requirements in Horizon 2020. Some of these publications were presented using Powerpoint presentations and/or posters. Furthermore, Track and Know team members gave presentations during workshops, summer schools, showcase events … about the project. All of these publications

and presentations were published on the project website and in the Continuous Reporting Module of SyGMa. Once the COVID19 pandemic made it impossible to physically attend conferences and organize workshops, summer schools and other events, the project partners fully focused on online events and webinars. For an overview, see Annex 14.

Audiences targeted	Track and Know
Availability / frequency	At least 30 with Open Access standards during the project duration
Who is responsible?	Realized by the project partners.

9.15 Work package telcos

To ensure a smooth progress in each work package, it is important that the involved researchers gather on a regular basis. These work package discussions were organized via teleconferencing according to a fixed planned calendar.

Audiences targeted	Track and Know team
Availability / frequency	On a regular basis
Who is responsible?	Planned by the project co-ordinator (Inlecom)

9.16 Project meetings

Several events will be organized by the Track and Know consortium of which three were gatherings of the project team, together with representatives of the EU and reviewers to discuss the project's approach, progress and results:

- The **project kick-off** was organized on **February 13 and 14 2018 in Attica (Greece)**. The goal of the kick-off was to discuss all the aspects of the project to ensure a smooth start. It concerns aspects such as: financial and administrative aspects, status and work plan of each work packages, management processes, contractual matters, etc. Each consortium partner was represented and participated actively in the discussions.

Audiences targeted	Track and Know team, commission, media
Availability / frequency	Once, in February 2018 (M2)

- The **mid-term review meeting** was organized halfway throughout the project, on **May 22 and 23 2019 in London (UK)**. The consortium gathered with the PO and reviewers for a mid-term evaluation of the project work and result. The conclusions of the mid-term review meeting had a steering effect on the second half of the project.

Audiences targeted	Track and Know team, commission,
Availability / frequency	Once, in May 2019 (M18)

- During the **final review meeting** the Track and Know consortium gathers with their PO and reviewers for a final evaluation of the project work and results. The meeting will mark the end of the three-year project activities and will take place online (due to the ongoing COVID19 pandemic) on February 10, 2021.

Audiences targeted	Track and Know team, commission, reviewers
Availability / frequency	February 10, 2021

Each quarter, a **face-to-face meeting** was organized for the project team to meet up and discuss several topics and the project status. As of March 2020, these meetings took place online due to the COVID19 pandemic.

9.17 Final event: 4 sessions at the online EBDVF 2020 event

We initially planned to organize a **closing event** to which all the different stakeholders would be invited. The Track and Know consortium would present the project results and recommendations in a user-friendly, accessible and relevant way. Unfortunately, the COVID19 pandemic made it impossible to organize a closing event that required physical attendance. As an alternative, Track and Know was strongly present in a diverse range of sessions at the 2020 edition of the **European Big Data Value Forum (EBDVF)** that took place from November 3 to 5 online. This event reaches out to the European Big Data and Artificial Intelligence community of professionals and interested audience. Track and Know presented its approach and several of its results in 4 sessions during the EBDVF 2020.

9.17.1 European Big Data Value Forum

The European Big Data Value Forum (EBDVF) is the flagship event of the European Big Data and Data-Driven AI Research and Innovation community organized by the Big Data Value Association (BDVA) and the European Commission (DG CNECT). The 2020 edition of the EBDVF took place between the 3rd and the 5th of November 2020, and was organized in collaboration with DFKI, Plattform Industrie 4.0, Plattform Lernende Systeme and Berlin Partner.

With a central theme "**Building a strong European Data and AI Ecosystem**", the EBDVF 2020 edition aimed to bring together the German and European communities on AI and Data. It aimed to contribute to the discussions on the European Data and AI Strategy, specifically addressing key topics for Europe such as the development of European Data Spaces, the importance of Technology Platforms and Trust, the opportunities for market uptake and the new challenges ahead for Data and AI within the society.

The event also focused on **how Data and AI can help to tackle emerging societal challenges**, like those brought by the Covid19 pandemic. For this edition, cross-sectorial tracks were combined with sectorial tracks on Manufacturing, Autonomous Systems, Transport, Mobility and Logistics, Health and Smart Society. Furthermore, the programme will include multiple research and innovation sessions and startups pitches, showcasing Europe's R&I excellence in Data and AI.

Audiences targeted	Track and Know team, scientific committee, public, policy makers, industry, commission, civil society, media
Availability / frequency	November 3-5, 2020 (M36)
Who is responsible?	Coordinated by Inlecom Group, UHasselt

Track and Know was involved in **4 separate sessions** throughout the event, from presentations about the project and its results to a led group discussion about the future, barriers and added value of Big Data research. In total, these sessions reached a diverse international audience of **659 stakeholders**.

This event and the separate sessions were actively promoted via the Track and Know project website and social media accounts, using promotional banners with a QR code to facilitate the online registration.

9.17.2 Parallel session on European Big Data Research for Industry. 3 projects. 7 sectors. 9 applications. 41 software components. Now what?" (I-BiDaaS Sponsored session)

The Big Data research projects **Track and Know** (Big Data for Mobility Tracking Knowledge Extraction in Urban Areas), **BigDataStack** (High performance data-centric stack for Big Data applications and operations) and **I-BiDaaS** (Industrial-Driven Big Data as a Self-Service Solution) hosted a joint session bringing together their findings in terms of barriers to adoption of Big Data research in different sectors as well as in terms of current and future impact of their research. Speakers also elaborated on the concrete business questions that have been answered in the project pilots.

Objectives:

The objective of this session was to discuss the findings of the three abovementioned Big Data research projects, present the barriers to adoption discovered in different sectors and the future impact and sustainability of Big Data research. This session took the form of a led group discussion on the impact and future of Big Data research (exchange of questions, experiences, ideas triggered by a set of key questions).

The session evolved around a led discussion for the participants to share their thoughts regarding the impact and future of Big Data research. The discussion was initiated by a set of questions to get the interaction going and to encourage participants to share their questions, experiences and views on Big Data research and the adoption of project outcomes and toolsets in the different sectors. Output of this session was a report with recommendations on *Big Data technologies ready to contribute to a European Big Data ecosystem, what's next?*

For Track and Know, Dr. Toni Staykova from UKeMED joined the panel of experts and she shared her experiences from the Track and Know health care pilot study. More concretely, she shed a light on how efficient Big Data handling could help beat the waiting list backlog in health care and also how Big Data handling is of massive importance in the ongoing worldwide battle with COVID19.

9.17.2.1 Report

A total of 117 people attended this led group discussion. Stakeholders were mainly coming from Greece, Germany, Spain and the Netherlands.
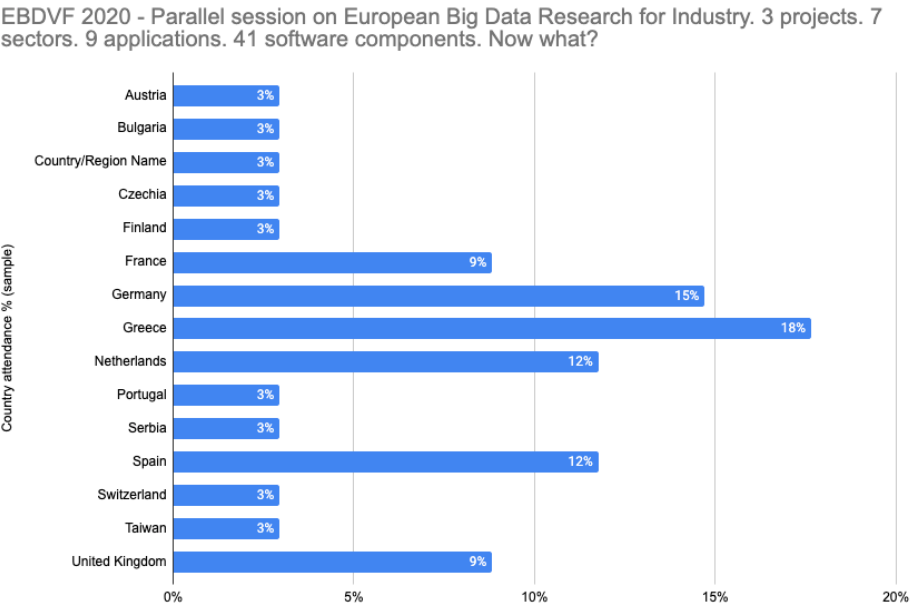
Figure 10: Registered attendees joint session

A participant's poll gave us a more detailed insight in our audience.
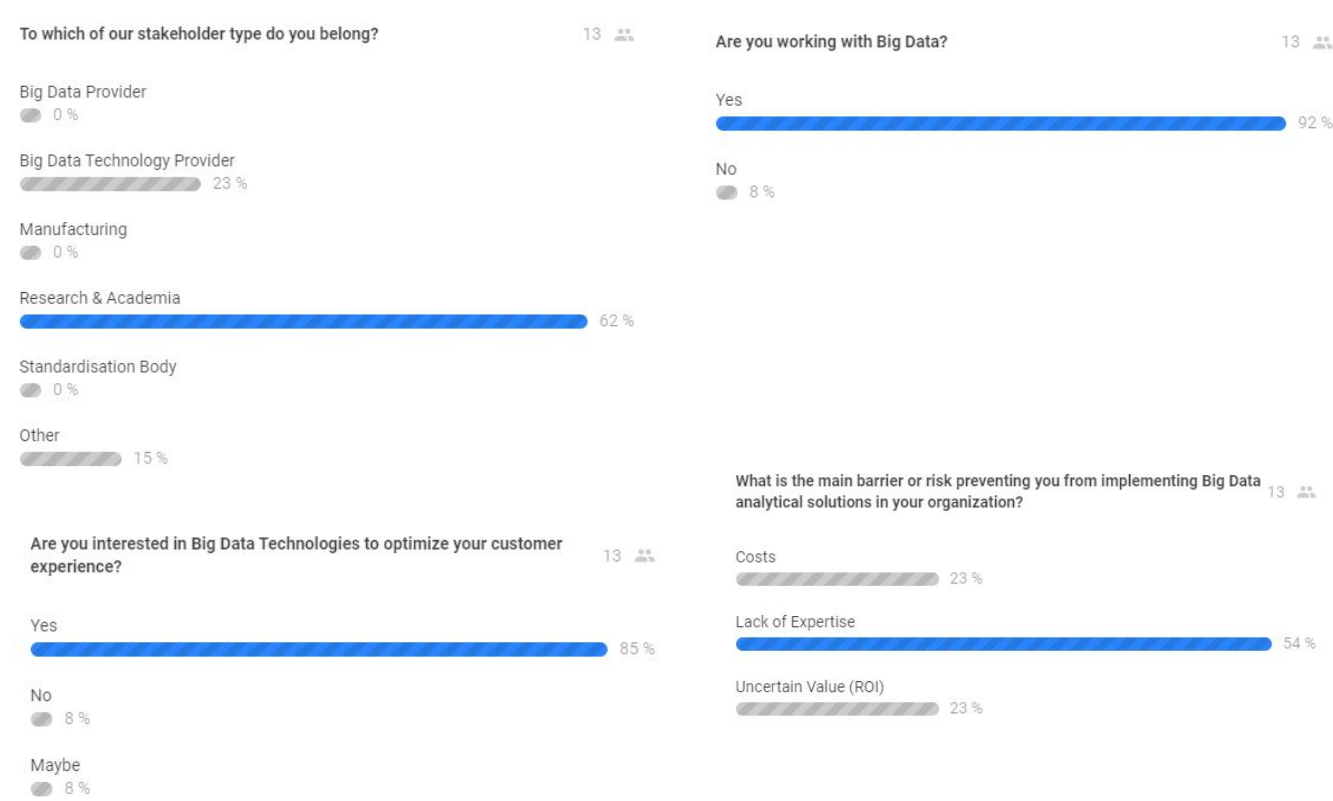
Figure 11: Poll results

Results show that 92% of the attendees were working with Big data. Most of them were active in research and academia or at a Big Data Technology Provider. The attendees identified a lack of expertise as the main barrier for the uptake of Big Data analytical solutions in their organizations. The results of this session were gathered in a joint report that is available on the Track and Know project website.

9.17.3 Sponsor Talk Track and Know - Big Mobility Data integration platform – approach, development and application

This session aimed at presenting the Track and Know project platform and at sharing and showcasing a robust and scalable platform for mobility data. It consisted of a 20-minute presentation by Marios Logothetis from project partner Intrasoft International, including screen shots and short demos of the Track and Know Big Data platform.

9.17.3.1 Report

This short and comprehensive sponsor talk was attended by 140 stakeholders. (data provided by the Whova, the platform on which the conference was hosted)

9.17.4 Evaluation schemes for Big data and AI Performance of high Business impact (DataBench project sponsored session)

Athanasios Koumparos from project partner Vodafone Innovus participated in the part of this session that focused on the project perspective on Big Data and AI architectural pipelines and benchmarks. He elaborated on Track and Know's approach to Big Data and the architecture and how it can be used to support such data in a fleet management case. He also discussed the needs of such a platform and/or data and the real benefits that could be derived from it. Organizations that face similar real life issues and participated in the event got a clear view of those benefits applied in targeted scenarios.

9.17.4.1 Report

This session reached a total of 255 attendees. (data provided by the Whova, the platform on which the conference was hosted)

9.17.5 Application Track 3: Transport, Mobility and Logistics - Main session

Currently the transformation of the multimodal transportation ecosystem is happening now – changes are rapid and involve all modes of transportation. New players use the power of real-time data to offer **personalized door-to-door travel and logistics services**. At the same time there is an expressed **need for an economical, flexible, safe, and more sustainable way to get from A to B** by road, rail or water – using all available innovative ways since:

- in most EU countries entrants are **challenging** the existing transport practices and services naming them as unable to fully satisfy a never-ending demanding audience;

- providers leverage the use of mobiles to **create new relationships with travellers**;

- societies have to reduce their CO_2 footprint, thus, **sustainability** becomes an important additional aspect of mobility and our mobility concepts;

Big Data, Data Issues and Artificial Intelligence can play an important part in achieving this vision. Yannis Theodoridis from project partner UPRC joined this session with his presentation which was entitled 'Learning from our movements'. He elaborated on the T&K objectives, datasets and toolboxes.

9.17.5.1 Report

This application track session had a total of 147 stakeholders. (data provided by the Whova, the platform on which the conference was hosted)

9.18 Stakeholder meetings

Stakeholder meetings were planned on a regular base to reach out to stakeholders in different sectors by keeping them informed on the projects progress, intermediate results and the possible applications and possibilities for their field of expertise. These meetings came in the form of presentations, workshops, Q&A sessions, etc. These meetings were crucial to validate and demonstrate the relevance and use of the Track and Know project to several industries and to demonstrate that project results can later be used in a wide variety of sectors in which Big Data are involved.

Audiences targeted	Stakeholders: policy makers, industry, investors, etc
Availability / frequency	At least 6 meetings (2 per use case: One for validating the use case requirements and one for validating the project outcomes)
Who is responsible?	Organized by the project partners

9.19 Liaison projects

Track and Know has carried out a strategic stakeholder engagement activity to maximise external user involvement and general acceptance of the technical developments of the Track and Know project. The goal has been to raise awareness of the project in general and engage with those stakeholders who are likely to benefit from and actively make use of the open source code and Track and Know platform.

A key part of this strategy has been liaison activities with other related research projects, this has been carried out with a view to identifying common areas of interest and promoting key outcomes. The goal has been to collectively raise the projects' profiles, promote knowledge transfer, identify where the partnerships can work collaboratively on developing common data governance and increase the uptake of results. The table below provides a list of the project identified in this engagement activity which included collaborative dissemination activities, contribution to data governance and sharing of research outputs. Full details are included in D7.4.

Project	Title	Topic	Website
DataBench	Evidence Based Big Data Benchmarking to Improve Business Performance	ICT-17-2016-2017	databench.eu
e-Sides	Ethical and Societal Implications of Data Sciences	ICT-01-2016	e-sides.eu

BigMedilytics	Big Data for Medical Analytics	ICT-15-2016-2017	bigmedilytics.eu
BodyPass	API-ecosystem for cross-sectorial exchange of 3D personal data	ICT-14-2016-2017	bodypass.eu
Extreme Earth	From Copernicus Big Data to Extreme Earth Analytics	ICT-12-2018-2020	earthanalytics.eu
Musketeer	Machine learning to augment shared knowledge in federated privacy-preserving scenarios	ICT-13-2018-2019	musketeer.eu
SmartDataLake	Sustainable Data Lakes for Extreme-Scale Analytics	ICT-12-2018-2020	smartdatalake.eu
I-BiDaas	Industrial-Driven Big Data as a Self-Service Solution	ICT-16-2017	ibidaas.eu
BigDataStack	High-performance data-centric stack for big data applications and operations	ICT-16-2017	bigdatastack.eu
SUITS Data Repository	Open Data Repository	H2020_MG-5.4-2015	dare.suits-project.eu

Table 8: Liaison projects

9.20 Demos

9.20.1 Big Data Pilot Demo Days webinar videos

The new data-driven industrial revolution highlights the need for big data technologies to unlock the potential in various application domains. To this end, BDV PPP projects **I-BiDaaS**, **BigDataStack**, **Track and Know** and **Policy Cloud** deliver innovative technologies to address the emerging needs of data operations and applications. To enable data operations and data-intensive applications to fully exploit the sustainability and take full advantage of the developed technologies, the PDV PPP projects brought on board use cases that exhibit their applicability in a wide variety of sectors.

This series of webinars aimed at **showcasing the implementation of the Big Data technologies in the pilot studies and their applicability to an ever wider scope.** The webinars demonstrated the actual solutions implemented performing big data operations and applications to interested end-users from industry as well as technology providers for further adoption in their own solutions and projects. The projects jointly illustrated how they contribute to Europe's digital future.

The following Track and Know webinars were part of these series, each of them focused on a project pilot study:

- July 7th, 2020: Athanasios Koumparos presented the Track and Know fleet management pilot. He focused on quality and predictions in location data from GPS devices.
- July 14th, 2020: Leonardo Longhi presented the insurance pilot and more specifically he elaborated on the use of mobility data to understand and mitigate risky driving behaviour.
- July 16th, 2020: the health care pilot was put in the spotlights. Toni Staykova, Ian Smith, Kieran Lee and Livio Brühwiler explained how effective use of patient mobility information can help to understand the provision of services across large rural and urban communities.

This webinar series was actively promoted via the Track and Know project website and social media accounts, using promotional banners with a QR code to facilitate the online registration.

9.20.1.1 Report

The Big Data Pilot Demo Days webinar series reached a total of **403 attendees**. More specifically, the Track and Know sessions, that took place on July 7th, 14 th and 16th, had a total reach of **236 registered attendees**. Geographically, the Greek stakeholders were the most numerous, followed by stakeholders from Italy and the United Kingdom.

Registrants/attendees per webinar	Attendees								
Country	21/05/2020	28/05/2020	18/06/2020	25/06/2020	02/07/2020	07/07/2020	09/07/2020	14/07/2020	16/07/2020
Albania	1								
Belgium					3	6	1	3	10
Bolivia	1								
Bulgaria					2				1
China						1		1	1
France	3	2	2	2		3	2	2	1
Germany	4	1	1	2		5		4	7
Ghana		1							
Greece	16	4	3	17	9	36	10	22	9
Hungary						1			
India			1						2
Ireland						1		2	2
Israel					1		1		
Italy	4	3	3	4	1	15	22	12	7
Luxembourg						1			
Malta			1						
Netherlands		1			1				1
Oman							3		3
Pakistan									1
Portugal				1					
Romania		2	2						
Rwanda							1		
Serbia	5								1
Spain	10	5	2	3	12		3	2	
Sweden									1
Switzerland			2	1		7	1	7	8
Taiwan		1							
Turkey							2		
United Kingdom	3	1	3	4	3	11	3	5	11
United States of America	1	2	4	3	2	7	4	2	11
Totale generale	**48**	**22**	**25**	**37**	**35**	**97**	**49**	**62**	**77**

Figure 12: Registrants/attendees per country and per webinar

The Big Data Pilot Demo Days webinar series reached out to various stakeholders, including **policy makers, retail sector, other sectors, finance and insurance sector, Big Data providers, Big Data Technology providers and Research and academia**.

Attendees - Main stakeholder categories

Policy Maker 0,8%
Retail Sector 1,6%
Other 11,4%
Finance and Insurance Sector 0,8%
Big Data Provider 5,7%
Big Data Technology Provider 10,6%
Research & Academia 67,5%
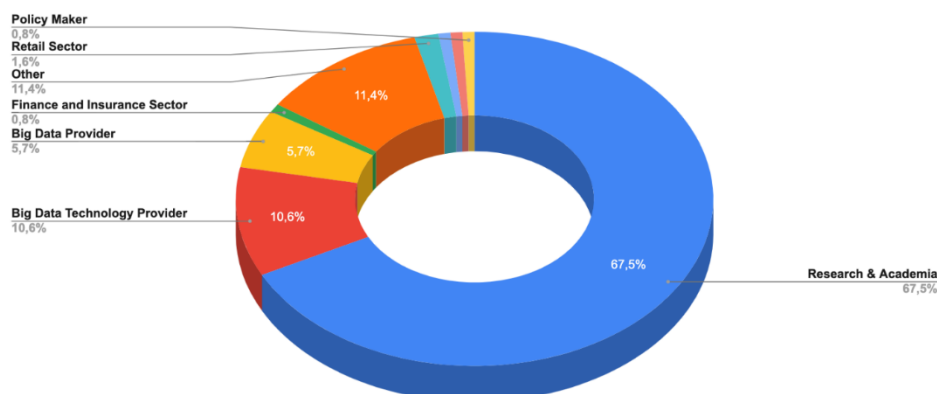
Figure 13: Main stakeholder categories

More specifically, the **Track and Know webinars** reached the below stakeholders, with a clear majority of research and academia:

07/07 - Attendee by stakeholder group	Percentage
Research & Academia	81%
Other	8%
Big Data Provider	6%
Big Data Technology Provider	3%
Policy Maker	3%

14/07 - Attendee by stakeholder group	Percentage
Research & Academia	79%
Big Data Technology Provider	9%
Other	6%
Big Data Provider	3%

16/07 - Attendee by stakeholder group	Percentage
Research & Academia	84%
Big Data Provider	9%
Big Data Technology Provider	3%
Other	3%

Table 9: Attendees Track and Know webinars

9.20.2 Other demos

In the upcoming months, the Track and Know consortium partners will present the project's achievements and results in various events through demos. The software tools will be demonstrated during webinars, at online industry events and conferences to reach out to a wide range of stakeholders.

9.21 Tutorial sessions and videos

For each of the analytics toolboxes that were developed during the Track and Know project, a tutorial session will be organized and recorded. These sessions will focus on the specific functionalities of the toolboxes and how they can be used in a wide range of industries. These Toolboxes include the real-time detection and forecasting of the Big Mobility Data Analytics Toolbox and the Predictive Complex Event Recognition Toolbox

Track and Know has developed the following toolboxes:

1. **The real-time detection and forecasting of Big Mobility Data Analytics (BDA) Toolbox;**
2. **The Predictive Complex Event Recognition (CER) Toolbox;**
3. **The Real-time Interactive Visual Analytics (VA) Toolbox.**
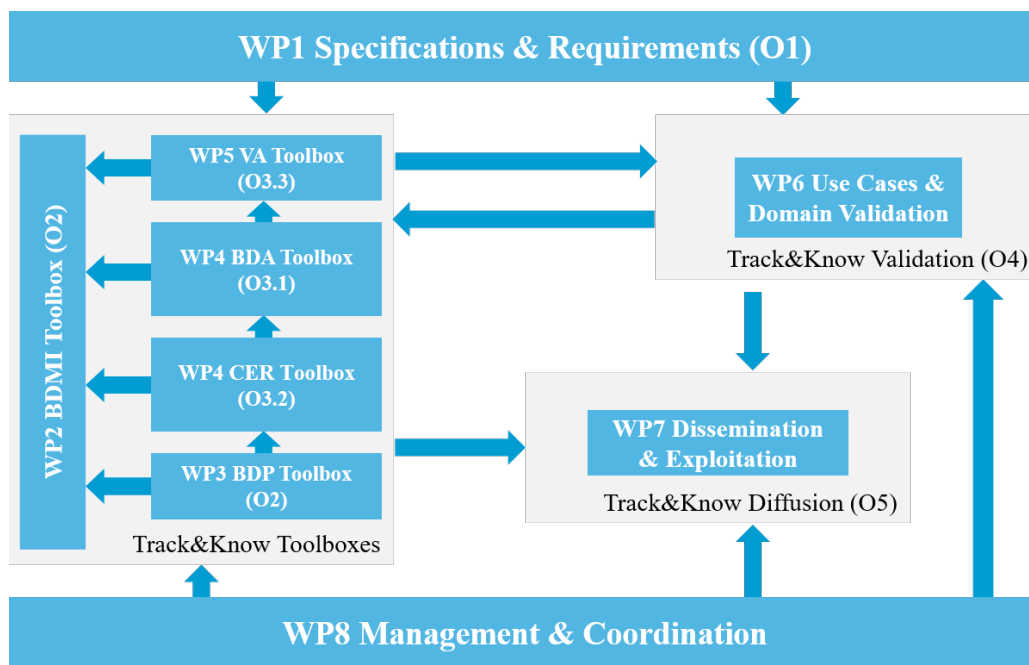
Figure 14: The Track and Know work plan and toolbox overview

Each of these toolboxes were tested, validated and evaluated addressing different industrial domains, such as the automotive mobility, health care and insurance sectors. Consequently, the consortium focuses on ensuring scale up trough wide dissemination, exploitation actions, liaison, clustering and correlation with other European and large-scale pilots and projects.

These toolboxes are highly relevant as they can have an important added value for many sectors where Big Data flows are involved. They will contribute to more effective and efficient data handling. Also, these toolboxes can be the key to solving many of today's challenges and problems in urban society. As soon as Track and Know researchers can explain to stakeholders how these toolboxes can be used and what they can do, the uptake by the industries can fully take off.

9.22 Course material

An **online course package** will be created for each toolbox, consisting of the following elements:

- a recorded tutorial session about the software toolbox
- relevant research papers and background information stemming from the project's pilot studies
- recordings of final event sessions or other relevant webinars

10 Activities plan

Communication tool	Type	Level	KPI's	Number of products	Intended target audience
Newsletters, Success Stories, Factsheets	Documentation	N, EU, I	Number of publications	10 (newsletters foreseen to be created in a quarterly basis)	4000 considering also the online distribution
Project Marketing Brochure	Documentation	EU	Number of contacted stakeholders	2 (one at the beginning of the project and one which is more results oriented)	2000
Papers, Press Releases etc.	Publication	I	Number of publications	6 to 10	4000 considering also the online sharing of the products
Deliverables (Public)	Publication	P, EU	QA Standards	31	4000
Policy briefs	Publication	EU	Number of publications	2	4000
Website - Social - Media	Online presence	I	SEO Metrics, number of users	1 website - 3 social media channels	4000 for website, 1000 facebook, twitter, linked in.
Promotional video	Online distribution	P	Number of views	1	4000 views downloadable from website and social media
Media releases	Online	P	Number of elements	6	4000
Project meetings, roundtables	Events	P	Number of events	20	Internal and invited stakeholder >50
Workshops, showcases	Events	I	Number of events/attendees	3	per 2000
Project liaison activities	Networking	EU	Number of relevant projects	10	> 50 per activity

Table 10: Activities plan

11 Monitoring and evaluation of dissemination activities

11.1 Key Performance Indicators (KPI's)

Dissemination goal	Target quantity
Publications (Scientific & Industrial target group)	Open access will be granted to all scientific publications resulting from Track and Know, targeting at Big-Data Analytics, Interactive Visual Analytics, Machine Learning, Data and Information management groups.
Papers at scientific conferences appearing in proceedings	At least 30 publications (ICT and ITS, Transportation Research Arena, Transport, Transportation Research Board Annual Meeting, Business & Marketing Conferences).
Papers in Journals	At least 12 publications in high impact journal (ICT and ITS, Transportation Research Arena, Transport, Transportation Research Board Annual Meeting, Business & Marketing Conferences).
Press releases	At least 2: One for the technological developments and their impact in each use case scenarios.
Web Site visits	800 p.a. with 1/3 spending more than 2 minutes on the site
Social Media Presence	Established groups in at least 2 networks (e.g. LinkedIn, Twitter) with regular updates. Evidence of engagement with target audience – demonstrated via comments, sharing of relevant content, RTs etc.
Stakeholders interest groups and meetings with stakeholders	At least 6 (2 per use case: One for validating the use case requirements and one for validating the project outcomes)
Demonstrations of prototypes at industry-dominated events	At least 2 (one big-data event, one smart mobility related event)

Bi-lateral collaboration with other projects working in the field established	Measured by existing exchange of knowledge and/or models or implementations. Track and Know targets at achieving high throughput and visibility within collaboration and exploitation synergies.

Table 11: Key Performance Indicators

For a full report on the **results** regarding the mentioned KPI's, please see Annex 13.

11.2   Monitoring tools

In order to measure the results of all the efforts in the field of dissemination and communication, it is necessary to set up dashboards and other monitoring tools. On a regular basis, results were gathered and reported to the consortium partners. These numbers and figures were the driving force behind a continuous cycle of monitoring and improving the dissemination and communication efforts.

One important principle to keep in mind is that the by simultaneously communicating through a very well thought out combination of channels (on- and offline) our actions will become much more effective. It is highly important that the various channels reinforce and complement each other. Therefore, planning and consistent monitoring all communication efforts is key.

11.2.1   Website monitoring tools

To be able to optimize the content of the project website, it is important to gain a thorough insight in the behaviour of website visitors. How do they end up on the website? Which pages do they view? How much time do they spend on the website and on certain pages? Why do they leave the website?

All of these data can be found and monitored through two Google dashboards that are directly linked to the project website. Google Analytics continuously registers and monitors all website visits and actions. To complement this dashboard, we use Google Search Console which offers an insight on the origin and source of website visitors. Which search terms do they use? Do they end up on the project website via other websites? This knowledge will also enable us to optimize the ranking of the project website (Search Engine Optimization).

11.2.2   Google Analytics

The Google Analytics dashboard provides a 24/7 registration of data for a wide range of parameters of which the following are some of the most important:

- **Page views:** total number of pages viewed. Repeated views of one page also count.
- **Unique page views:** the number of sessions during which the specified page is displayed at least once. A unique page view is counted for each combination of page URL + page title.
- **Unique site visitors:**
- **Average time on page/website:** the average amount of time visitors spent viewing a specified page or series of pages.
- **Bounce rate:** the percentage of sessions where only one page is viewed where there is no interaction with the page. A session that has been bounced has a duration of 0 seconds.

The Google Analytics dashboard for the Track and Know project website has been activated on July 1st, 2019. Data are available from that date onwards. For the period between the start of the project, in January 2018, up until July 1st, 2019, we will use an estimation based on the data retrieved from Google Analytics between July 2019 and December 2020.

See Annex 9.

11.2.3 Social media monitoring tools

Social media monitoring enables us to optimize the content we post on the social media channels, to target our desired audience in more effective way and to build a bigger and better community. By monitoring data which are available via the (free) dashboards, we obtain a good insight in the quality and effect of our posts. Each of the used social media platforms has its own monitoring tools.

- Facebook offers insights, including a wide range of figures and graphics about post engagement, popular types of posts, etc that are available for a chosen period of time (see annex 10)
- Twitter also offers insights but they automatically make a monthly report of the most popular content, top followers, evolution in number of followers. (see annex 11)
- LinkedIn includes very minor monitoring tools for groups, however it is possible to monitor the evolution in group members and the post engagement per post. (see annex 12)

12 Sustainability of online presence

12.1 Project website

The project website will remain available online for 5 more years after the end of the project, more concretely the site will be online up until December 2025. Project partner Hasselt University is responsible for maintaining the website and keeping it safe and free of any malicious content. Hasselt University will do so by executing the necessary updates on a regular basis.

12.2 Social media accounts

The social media accounts that are linked to the project (Facebook, Twitter, Linkedin) will be available up until December 2025 as well. Project partner Hasselt University is responsible for maintaining the accounts and keeping them safe and free of any malicious content. Hasselt University will do so by monitoring the accounts on a regular basis.

13 Conclusions

Ever since the beginning of the Track and Know project, the main focus in the field of communication and dissemination has been the use of a **broad, highly accessible media mix** which included very popular media (like Facebook and YouTube) as well as more professional media (for instance scientific magazines). With **comprehensible language and the use of videos** we have tried to open up this very technical project to the general public, which was one of the biggest challenges. Our **multi-channel approach and continuous efforts** to communicate about the project's progress and results also focused a lot on the **pilot studies** in health care, insurance and fleet management, since they enabled us to make the project results highly relevant and comprehensible to the public. Due to the current COVID19 pandemic in the last year of the project, we quickly shifted to **online events** and focused on being present at online conference and webinar series. The consortium also turned technical presentations into **accessible, insightful tutorials and short explainer videos**, making the project's YouTube channel a highly valuable asset for the dissemination and communication strategy.

Best practices include the success stories, including a **successful story** about the health care pilot. In July 2019, this story was shortlisted for the Success Story Awards at the BDV PPP summit 2019 in Riga. The story was entitled **'Sleep well – drive safely – a tale of mobility tracking and Big Data'**. Dr. Angelos Liapis, CEO of Track & Know partner Konnekt-able Technologies Ltd., did a great job presenting the Track & Know success story at the event as his presentation attracted excitement and gained visibility for the entire project. The annual BDV PPP Summit is the primary event for driving European innovation in Big Data and Artificial Intelligence. Key European industry, academia and policy-making players gathered in Riga to foster cross-sector collaboration and shape strategies for European leadership in data-driven Artificial Intelligence. Each year, the Summit welcomes hundreds of organisations involved in Big Data Public Private Partnership as well as all those who want to be part of the thriving European Big Data Ecosystem. Another more recent success story about **electric vehicles and the use of Big Data** by Mirco Nanni from project partner CNR illustrated the relevance of this project to our future society. The story is visualized in a short, insightful video which is available on the YouTube channel. Those stories enable the consortium to reach out to the general public with a comprehensible view of very technical content.

Also, the project's pilot studies have proven to be perfectly fit for **webinars** and thus attract attention to the rest of the Track and Know project. Our participation in the Big Data Pilot Demo Days Series of webinars focused on those three pilots and aimed to **showcase the societal relevance of our research**. While Big Data handling is hardly anything people would lose their sleep over nowadays, waiting lists in hospitals and practical car problems are. The ultimate goal was not only to increase awareness about the project but also to stimulate the uptake in several sectors. Without simplifying the project's approach and results too much, our researchers succeeded in bringing across the importance of effective and efficient Big Data handling for all of us. Also, during the project's final event at the EBDVF 2020 event, several of our consortium partners took part in session to elaborate on the project's results and focus on what that could mean for a variety of industries.

Our conviction is that this project has only marked a beginning of the use of the produced software toolboxes and methodologies and took on a pioneering role in making society, the public and the industries aware of the importance of effective and efficient Big Data handling in a future-proof society.

Annex I: Communication and dissemination plan matrix

Communication tool	Type	Level	KPI's	Number of products	Intended target audience
Newsletters, Success Stories, Factsheets	Documentation	N, EU, I	Number of publications	10 (newsletters foreseen to be created in a quarterly basis)	4000 considering also the online distribution
Project Marketing Brochure	Documentation	EU	Number of contacted stakeholders	2 (one at the beginning of the project and one which is more results oriented)	2000
Papers, Press Releases etc.	Publication	I	Number of publications	6 to 10	4000 considering also the online sharing of the products
Deliverables (Public)	Publication	P, EU	QA Standards	31	4000
Policy briefs	Publication	EU	Number of publications	2	4000
Website - Social - Media	Online presence	I	SEO Metrics, number of users	1 website - 3 social media channels	4000 for website, 1000 facebook, twitter, linked in.
Promotional video	Online distribution	P	Number of views	1	4000 views downloadable from website and social media
Media releases	Online	P	Number of elements	6	4000
Project meetings, roundtables	Events	P	Number of events	20	Internal and invited stakeholder >50
Workshops, showcases	Events	I	Number of events/attendees	3	per 2000
Project liaison activities	Networking	EU	Number of relevant projects	10	> 50 per activity

Annex 2: Project website (screenshots and important features)

First version (launch January 2018)

1. Homepage
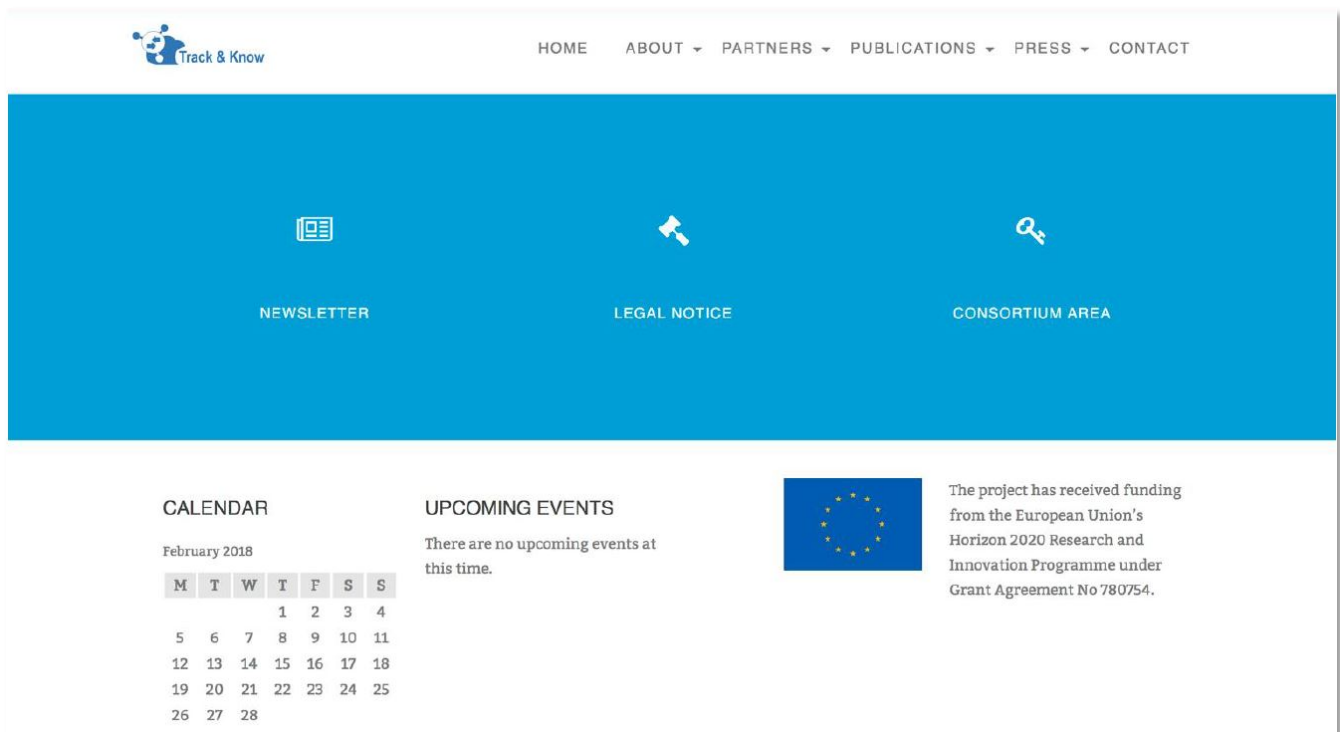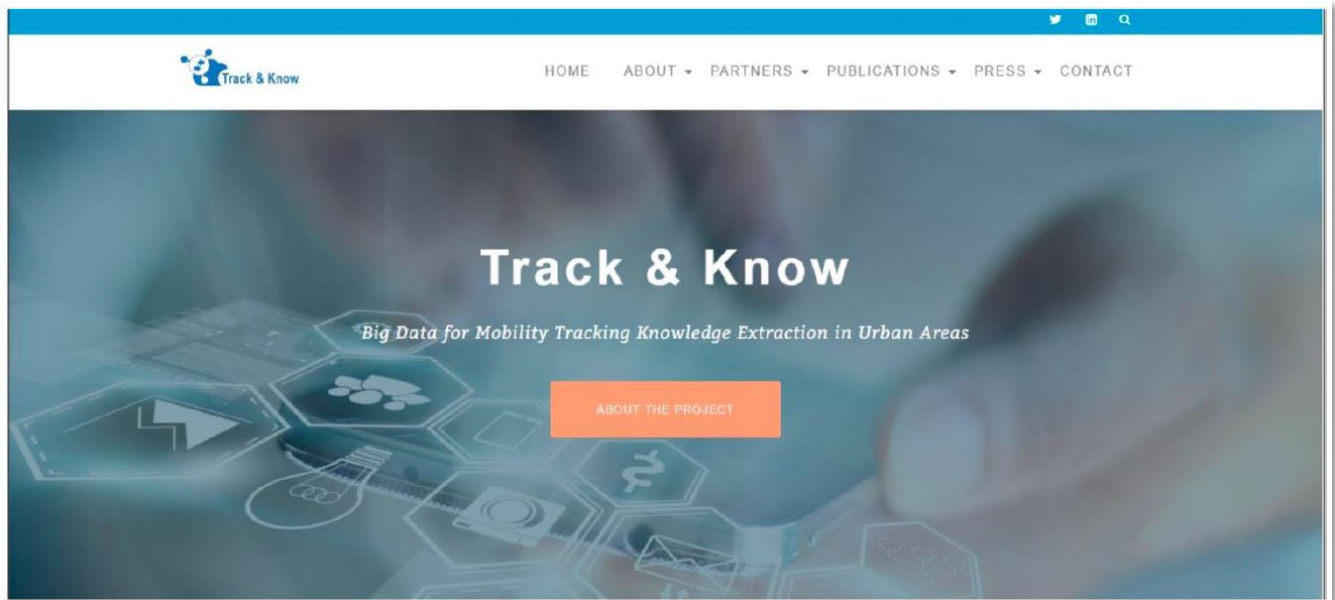
2. Other pages:
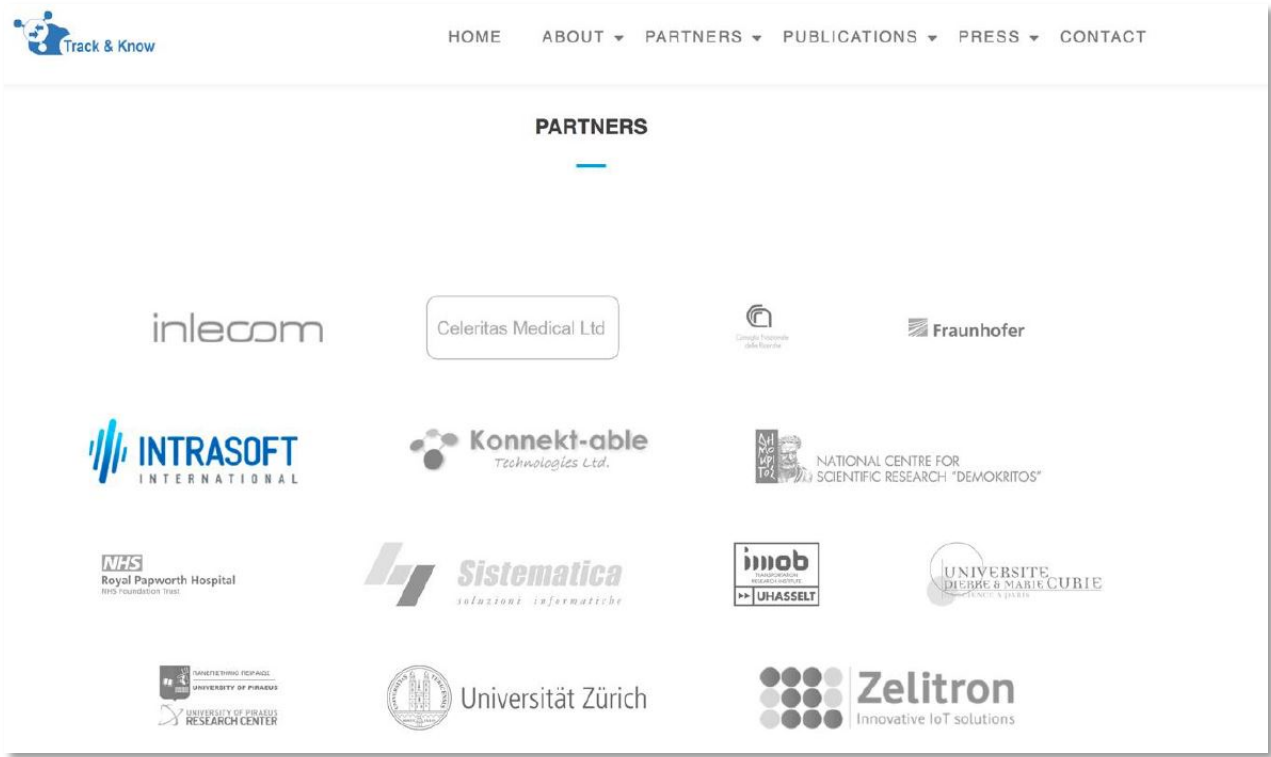
Updated version (launch June 2019)

1. **homepage**
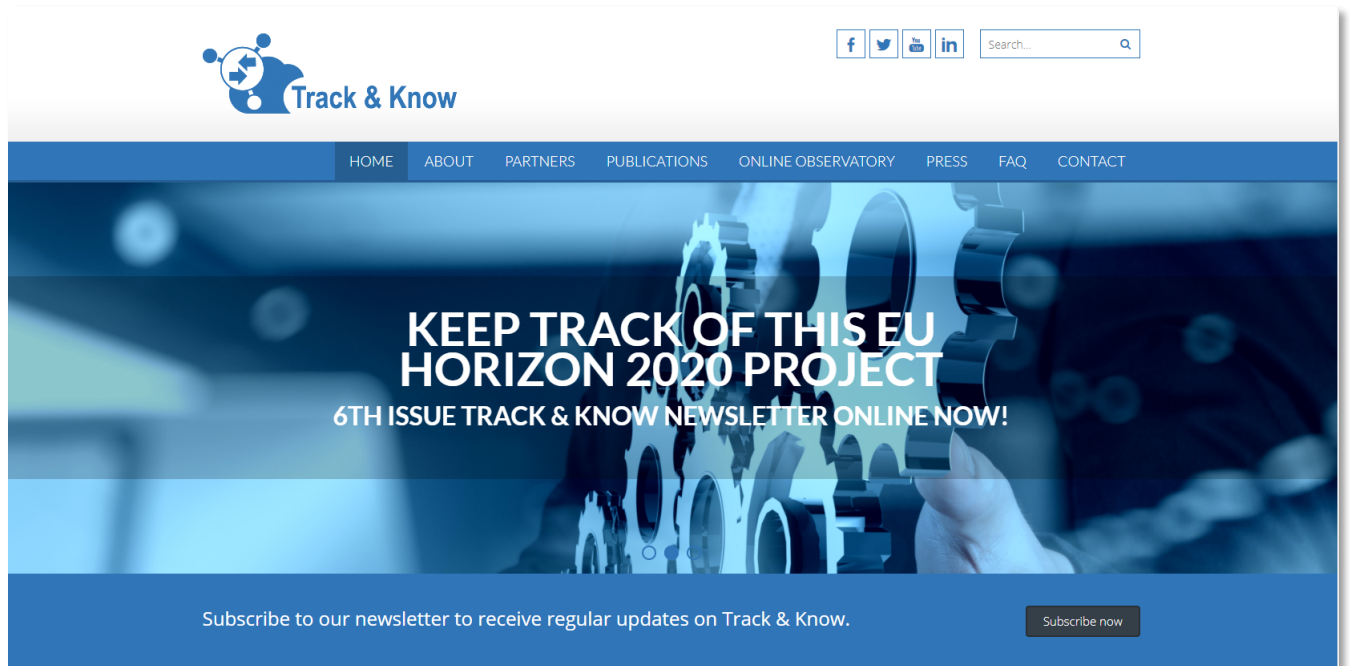
Important features:

- **Social buttons** at the top right corner
- **Call to action which is positioned above the 'fold' (visible without having to scroll down):** "Subscribe to our newsletter to receive regular updates on Track and Know."
- **Project explainer video** is available on the homepage

- **News section** with the latest news items

- Footer with event calendar, project insights, site menu, gallery and a Twitter feed.

2. Focus on news on every page

- **Banner** with the latest news (and upcoming events) on the right hand side of every page (except for the homepage)
- **Social buttons** at the left of the screen that facilitate sharing a news item on social media (Facebook, Twitter, LinkedIn or via email) in just one click
- **News corner** where all news items are chronologically available

3. Online observatory

The page includes a button which leads to **road map** (PDF file) for users to find their way through this extensive online library and therefore increase the user friendliness of this observatory.

4. Other pages and features aiming for a better user experience

- **FAQ page:** via each of the six clickable tiles you can reach a page which focuses on a set of questions. At the bottom of each FAQ page is a button to return to the page with the tiles.

- **Insights page:** short, comprehensive items that focus on a specific video, publication, software tool as part of the Track and Know project, etc. This page can be reached by clicking on the 'insights' section on the homepage.

Updated version to disseminate results at the end of the project (December 2020)

- Call to action about the online observatory
- Showcase or project results
- Prominent place for news
- Addition of a video section in the footer

ABOUT

Track & Know is a Horizon2020 project, with a focus on Big Data. More specifically, Track & Know, which is an acronym for **"Big Data for Mobility Tracking Knowledge Extraction in Urban Areas"**, will **research, develop and exploit a new software framework that aims at increasing the efficiency of Big Data**.

This will be applied in the **transport, mobility, motor insurance and health sectors**.

Track & Know aims to introduce innovative software stacks and toolboxes addressing new emerging cross-sector markets related to automotive transportations and urban mobility in general: commercial IoT services; car insurance; and, healthcare management. The addressed markets have significant industrial and commercial impacts for EU enterprises.

NEWS

European Big Data Research for Industry – 3 projects, 7 sectors, 9 applications, 41 software components. Now what? – Report online now!

On Tuesday November 3rd, 2020, within the framework of the European Big Data Value Forum, Big D...

Throwback to Track & Know's final event

Early November, Track & Know's final event took place during the European Big Data Value Fo...

European Big Data Value Forum 2020

The European Big Data Value Forum (EBDVF) is the flagship event of the European Big Data and Data-D...

7th Track & Know newsletter online!

Catch up on all there is to know about this Horizon 2020 project in the 7th issue of the Track &amp...
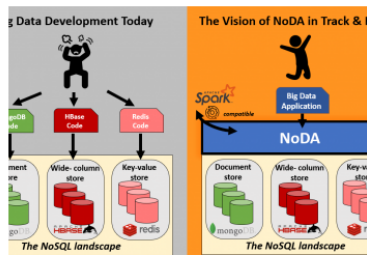
NODA – UNIFIED NOSQL DATA ACCESS OPERATORS

Find out everything about this part of the Big Data Processing Toolbox. NoDA offers the opportunity to access big data through a unified operator's framework, without having to learn the query languages of each NoSQL database store. https://youtu.be/Rf6OY...

READ MORE
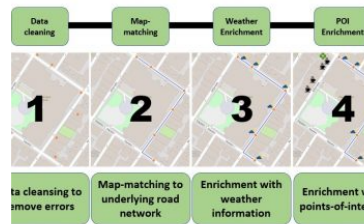
DATA CLEANING & ENRICHMENT PIPELINE

Find out everything about this exciting new tool which is part of the Big Data Processing Toolbox. This tool enables us to clean streaming data (GPS traces) and enrich raw data with usefull information through several scalable big data technologies. http...

READ MORE
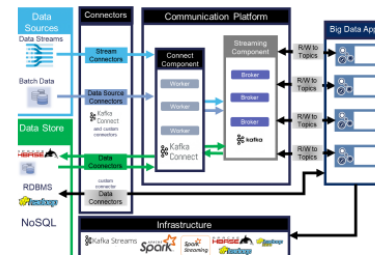
BIG MOBILITY DATA INTEGRATOR

One of the major objectives of the Track & Know project is to integrate online data streams, heterogeneous, contextual and archival data on one big data platform. This enables big data experts and stakeholders to advance their operational, processing and ...

READ MORE

UPCOMING EVENTS

There are no upcoming events at this time.

VIDEOS

INSIGHTS

Discover the Track & Know Big Data Integration Platform in this 7-minute webinar by Marios Logothetis from consortium partner Intrasof...

Big Data Integration Platform

View All Insights

Annex 3: Project triptych flyer

Track & Know

Track & Know Consortium

The Track & Know consortium is composed of 14 complementary partners, coming from addressed research, technological and commercial domains, that have a proven track record of high quality research capacity.

Inlecom Group BVBA – Belgium

Cambridge Medical Academy Ltd. – United Kingdom

Consiglio Nazionale Delle Ricerche – Italy

Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V. – Germany

Intrasoft International SA – Luxembourg

Konnekt-able Technologies Limited – Ireland

National Center for Scientific Research "Demokritos" – Greece

NHS Royal Papworth Hospital – United Kingdom

SISTEMATICA – Italy

Universiteit Hasselt – Belgium

Sorbonne Universite – France

University of Piraeus Research Center – Greece

Universitaet Zuerich – Switzerland

Vodafone Innovus - Greece

Big Data for Mobility Tracking Knowledge Extraction in Urban Areas

Track & Know

Find out more about Track & Know

If you are interested in getting updates on Track & Know and participating in upcoming events, please visit our website or follow us on social media. You can also sign up for our regular newsletter or contact the project coordinator:

Project coordinator

Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

https://trackandknowproject.eu
Twitter: @TrackandKnow
Facebook: Track & Know
LinkedIn: Track & Know
Researchgate

Introduction

Track & Know is a three-year research and innovation project funded under the European Union's H2020 programme. The Track & Know project brings together interdisciplinary partners from the transport, insurance, emergency healthcare industries, academia and research along with users and data-provision partners focusing on real-life and user-defined challenges. The consortium aims to address the open issues arising from the automotive transportation in modern metropolitan areas and increase the contextual awareness in urban mobility by delivering intelligent information and predictive analytics to user-interest groups, stakeholders and city managers.

The overall objective is to research, develop and exploit a new software framework that aims to increase the efficiency of Big Data applications in the transport/mobility, motor insurance and health sectors. A variety of toolboxes (that contain specific methods / functions / algorithms for various types of data aggregation, manipulation and further analysis) are developed within the project, and integrated in a software platform.

Objectives

Track & know objectives and their achievement approach are in line with the EU Big Data Value Reference Model from the Big Data Value Association.

The key technical objectives are as follows:

1. Development of a scalable, fault tolerant platform for the management of Big Data coming from various sources

2. Development of efficient, interoperable and scalable Track & Know toolboxes and their integration in the platform

3. Testing, validation and evaluation of the Track & Know toolboxes addressing different industrial domains, such as mobility, health and insurance

Apart from the above, Track & know developments will be scaled up through wide dissemination, exploitation actions, liaison, clustering and correlation with other European and large-scale pilots and projects.

Big Data Platform

Track & Know Big Data platform integrates online data streams, heterogeneous, contextual and archival data, that enables experts and stakeholders to advance their operational, processing and decision making activities. The platform is a fully featured industrial grade solution:

- that is able to scale out and accommodate various big data from different domains, interoperating with all modern data storage technologies as well as other persistence approaches.

- that can support all important big data languages including Python, Java, R and Scala as well as other traditional programming approaches.
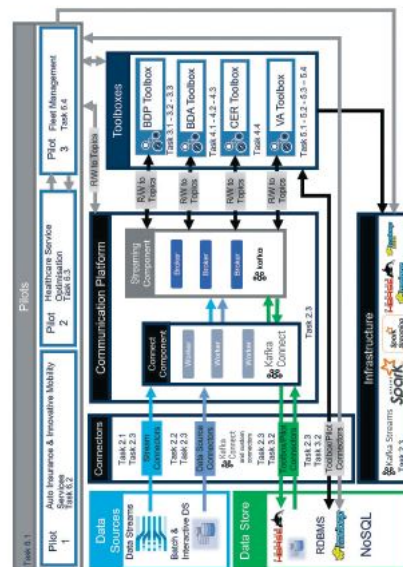
Toolboxes

Four toolboxes will be developed within the Track & Know project, which are core of the Big Data platform and carry out a variety of different tasks.

A Big Data Processing (BDP) toolbox is developed to implement data acquisition technology that captures data from heterogeneous data sources. The BDP toolbox extends the current solutions and delivers a tool for efficient access, indexing, partitioning and load balancing for big spatiotemporal data.

The Big Data Analytics (BDA) toolbox is developed to analyse heterogeneous data and to draw conclusions about the spatiotemporal distribution of mobility patterns. The BDA toolbox delivers scalable data mining techniques (such as clustering, sequence mining, hot-spot analysis) for voluminous offline and online trajectory data.

A Complex Event Recognition (CER) toolbox (as part of BDA toolbox) detects complex event occurrences by analysing patterns in simple events. To do that, it uses contextual information and results from the BDA toolbox. The CER toolbox will advance the state-of-the-art by developing online learning techniques for complex events in big mobility data.

A Visual Analytics (VA) toolbox develops interactive and scalable methodologies to visualize data at all steps of the analysis.

Pilots

The Track & know Big Data platform and developed toolboxes are used to answer a variety of business questions in three different pilots. Questions within these three pilots are as follows:

Auto Insurance & Innovative Mobility Services: In-depth and accurate crash probability estimation, cost-benefit analysis of switching to electric mobility, carpooling potential and their underlying benefits.

Healthcare (Primarily for Obstructive Sleep Apnoea patients): Medical service optimisation to improve response time and reduction of unnecessary travel, diagnoses potential based on exploration of driver behaviour.

Fleet Management: Predictive maintenance, exploration of ways to detect data anomaly and reduction of false alarms, cost reduction potential and driver behaviour improvement to reduce accidents.

Annex 4: Project newsletters – issues 1 up to 7 (issue 8 will be released at the end of the project)

Track & Know

PROJECT NEWSLETTER

Track & Know | Issue 1 | Date: April 2019

WELCOME TO THE FIRST TRACK & KNOW NEWSLETTER!

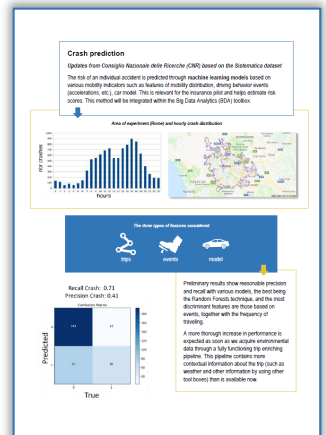In this first newsletter, you can find news on:

- The overall scope of the project
- The first results based on our first data analysis
- Publications of 2018

Project coordinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

ABOUT THE NEWSLETTER

This newsletter informs you about the results and activities of the EU H2020 research project Track& Know. The aim is to keep all relevant actors interested in managing big data, more specifically on the type of big data we focus on in the project and the tools/methods we develop to handle, analyse and visualize these datasets. T&K focuses on resolving key business cases for 3 test pilots, namely transport/mobility, insurance and health care. Business cases which will be explored in these pilots are as follows but not limited to: minimizing patients travel, carpooling and electric mobility potential, driver behaviour profiling etc.

THE OVERALL SCOPE OF THE PROJECT

Track & Know researches, develops and exploits a new software framework that aims to increase the efficiency of Big Data applications in the transport/mobility, motor insurance and health sectors. A variety of toolboxes (that contain specific methods / functions / algorithms for various types of data aggregation, manipulation and further analysis) are developed within the project, and integrated in a software platform.

A Big Data Processing (BDP) toolbox is developed to implement data acquisition technology that captures data from heterogeneous data sources. Current available solutions can handle spatial and temporal data separately and therefore fail to exploit spatiotemporal correlations present in mobility data. The BDP toolbox extends the current solutions and delivers a tool for efficient access, indexing, partitioning and load balancing for Big spatiotemporal data.

A Complex Event Recognition (CER) toolbox detects complex event occurrences by analysing patterns in simple events. To do that, it uses contextual information and results from the BDA toolbox. For example, the toolbox may infer a complex event (such as dangerous driving or non-economical driving) by analysing patterns based on vehicle speed, direction, driver events, fuel consumption and other contextual information such as weather etc. The CER toolbox will advance the state-of-the-art by developing online learning techniques for complex events in big mobility data.

The Big Data Analytics (BDA) toolbox is developed to analyse heterogeneous data and to draw conclusions about the spatiotemporal distribution of mobility patterns. Current available analytical models fail to scale for big datasets and/or online streaming data. The BDA toolbox delivers scalable data mining techniques (such as clustering, sequence mining, hot-spot analysis) for voluminous offline and online trajectory data.

A Visual Analytics (VA) toolbox develops interactive and scalable methodologies to visualize data at all steps of analysis. Current approaches supports visualization for only a few analysis steps and therefore, does not provide explicit understanding. The VA toolbox can efficiently handle both historical and streaming spatiotemporal data originating from different sources, with varying levels of resolution and quality.

To put theory into practice, we integrate the toolboxes in a platform and test them in pilot cases that serve as a test-bench for the stakeholders to evaluate developments using realistic data. We organise pilot cases in three domains: transport/mobility, insurance and health care. A variety of business questions will be answered in each pilot using the developed toolboxes. For example: detecting errors in the trajectory data and their corrections, travel route features and predictions, driving behaviour categorisation and risk scoring, location of mobile health units so as to minimize travel distance for patients, potential for carpooling and electric mobility etc. For more information, please visit the project website: www.trackandknowproject.eu.

Distribution of car type usage

Initial Analysis of dataset obtained from Sistematica, ICT innovators (SIS), Italy for London region

The analysis provides an idea about which type of car appears on which type of road. This makes it possible to depict their geographical markets and to see where a particular brand has a higher accident risk based on the geographical distribution. Coupled with other contextual information, the analysis can help to answer questions relevant to the insurance pilot.

About two weeks of data were gathered in the UK (greater London area) regarding the distribution of car brands. 15 top brands that have at least 80 cars during the considered period were selected. We applied our trajectory summarization procedure for tessellating the area into about 3,500 polygons of similar sizes (from our visual analytics toolbox). Next, we aggregated the trajectories by these polygons separately for the 15 brands. As a processing result, we have clustered the polygons according to the similarity of these "car population structures" and got a nice map. Polygon colours reflect the similarity of the car population profiles. Colour meaning is explained in the bar chart at the top.

The map gives a nice overview of the structure of the road network and land use in the area. Main motorways are dominated by VAUXHALL, FORD and VOLKSWAGEN. Central London and Brighton are characterized by a mix of everything, with some prevalence of VAUXHALLs and FORDs. You can find nice FIAT, FORD, SEAT, PEUGEOT and VOLKSWAGEN "villages".

Follow the Track & Know project on Twitter, LinkedIn and periodically visit our website for more interesting analyses and visualizations of the dataset used in the project.

SOME PRELIMINARY RESULTS

Geographical Distribution of patients who may be suffering from Obstructive Sleep Apnoea (OSA)[1]

Patients from Royal Papworth Hospital (RPH), Cambridge, England and Outreach Clinics (outreach exchange facility) in the surrounding region.

The figure (Source: Inlecom Systems BVBA, Belgium) shows the results of the first retrospective analysis of the geographical distribution of patients requiring OSA testing, monitored from 2013-2018. Patients, monitored by RPH are visualised with a green triangle. Patients, monitored by an outreach exchange facility are visualized with black and blue stars.

Figure 1: All patients in catchment 2013-2018

This image has allowed us to visualise the distribution of OSA patient clusters and how these clusters relate to exchange facility locations. You can see that many outreach facility centres are ideally placed, hitting the areas with lots of patients. But additionally you can also see the service is far from optimal and that many patients have to travel vast distances to get access.

The next analysis will look at what is the best way of re-distributing the exchange facilities to reduce overall travel distance, and adding another layer to the map showing the spatial variation of demographic risk factors that would make someone likely to need to undergo a diagnostic test for OSA. In other words to find out if there are geographical areas that are in need of tests, but not currently getting access to them. Although these results are very early and there is a lot more we still hope to achieve in the Track and Know project, the approach being used is generating a significant degree of interest. The type of research is fresh and novel within the area of OSA and possibly underutilised in the field of medicine as a whole.

At present these preliminary results are being used by RPH consultants to justify the importance of maintaining outreach services. In particular the hospital is having to defend the need for an outreach in Harlow (Lowest blue star), and to get General Practitioners (GP's) in Peterborough (2 black starts top left) to improve their level service. The fact that research results are being used, already at such an early stage highlights how well this type of analysis is being received, and offers a good deal of promise that our next steps will lead to something highly beneficial.

[1] Obstructive sleep apnoea (OSA) is the most common type of sleep apnoea and is caused by complete or partial obstructions of the upper airway. The patients involved in the study are not diagnosed with OSA yet, but there is a strong suspicion that these patients may suffer from OSA. For that reason those patients have to use an expensive device.

PUBLICATIONS 2018

- Nikitopoulos P., Paraskevopoulos A.-I., Doulkeridis C., Pelekis N., Theodoridis Y. (2018) Hot Spot Analysis over Big Trajectory Data, in *Proceedings of the 2018 IEEE International Conference on Big Data (IEEE BigData 2018)*. Download here

- Markovic N., Sekula P., Vander Laan Z., Andrienko G., Andrienko N. (2018). Applications of Trajectory Data From the Perspective of a Road Transportation Agency: Literature Review and Maryland Case Study, *IEEE Transactions on Intelligent Transportation Systems*. Download here

- Collins C., Andrienko N., Schreck T., Yang J., Choo J., Engelke U., Jena A., Dwyer T. (2018) Guidance in the human-machine analytics process, *Visual Informatics*, vol. 2(3), pp 166-180. Download here

- Li J., Chen S., Zhang K., Andrienko G., Andrienko N., (2018) COPE: Interactive Exploration of Co-occurrence Patterns in Spatial Time Series, *IEEE Transactions on Visualization and Computer Graphics*. Download here

- Katzouris N., Michelioudakis E., Artikis A., Paliouras, G. (2018). Online learning of weighted relational rules for complex event recognition. In *Joint European Conference on Machine Learning and Knowledge Discovery in Databases*, pp. 396-413, Springer, Cham. Download here

Find & Follow us
Website: https://trackandknowproject.eu
Twitter: @TrackandKnow
LinkedIn: Track & Know
Researchgate

Track & Know

PROJECT
NEWSLETTER

Track & Know | Issue 3 | Date: June 2019

WELCOME TO THE THIRD TRACK & KNOW NEWSLETTER!

In this newsletter, you can find:

- reflections on the mid-term event of the project
- reflections on some key project liaison activities, stakeholder workshops/webinars and conference participations
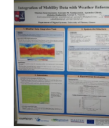
ABOUT THE NEWSLETTER

This newsletter informs you about the project mid-term event and other liaison activities of the EU H2020 research project Track & Know. The aim is to keep all relevant actors interested about the progress made in different research tasks in relation to managing big data, more specifically on the type of big data we focus on in the project and the tools/methods we develop to handle, analyse and visualize these datasets. Track & Know focuses on resolving key business cases for 3 test pilots, namely transport/mobility, insurance and health care. Business cases which will be explored in these pilots are as follows but not limited to: minimizing patients travel, carpooling and electric mobility potential, driver behaviour profiling etc.

Project coordinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

Participation in 10th EDBT/ICDT Conference and Workshop

Prof. Christos Doulkeridis and his colleagues from UPRC attended the conference held on March 26-29, 2019 in Lisbon, Portugal. Attendees were mostly made up of researchers and practitioners community in the domain of database technology and data theory from all around the world. UPRC researchers presented a research paper about the 'integration of mobility data with weather information'. The main novelty of the method is its applicability to streaming/online mobility data coming as a trajectory from on-board vehicle GPS units. This method is an important part of the Big Data processing toolbox being developed in the Track & Know project. The code for the method is available here and more details about the method can be read from the research paper.

Participation in 23rd Pacific Asia Conference on Knowledge Discovery and Data Mining

Riccardo Guidotti from CNR attended the conference held on April 14-17, 2019 in Macau, China. Attendees were mostly made up of researchers and practitioners community in the domain of computer science and data scientist from all around the world. CNR researchers presented a research paper about the 'Investigating Neighbourhood Generation Methods for Explanations of Obscure Image-Classifiers'. The paper presents a comparison of several grid-based methods that redesign the neighbourhood generation of LIME. This method is an important part of Big Data analytics toolbox being developed in the Track & Know project. The code and paper can be read from here.

Participation in Kunming International Health Forum

Takis Kotis, CEO of CEL attended the event held on 1st December 2018 in China. The Track & Know project was presented as example for innovative approach of Big data applications for health service optimisation. Audience ca. 300, stakeholders from various health care domains - medical, IT, R&D, management, policy makers, industry. Two types of stakeholders showed interest in the future outputs: a) medical (stakeholder category "direct users of the system") - to learn more about OSA service, as the risk factors are increasing in China and b) industry (stakeholder category "result beneficiaries") - anticipating that there will be increasing demand for supplies of diagnostic and therapy equipment and the Big Data analytical approach will help with forecasts of service demands.

Collaboration Visit to two Hospitals in Wuhu, China

On 21st March 2019, Dr Toni Staykova presented "Cambridge Medical Academy (new name of CeleNass) - Research and Innovation" two hospitals in Wuhu China. The name of the hospitals are the Second Affiliated Hospital of Wannan Medical College and the First Affiliated Hospital of Wannan Medical College. From these hospitals around 60 stakeholders who can be the direct users of the system (i.e. Doctors and Administrators) have attended the talk. Audience were interested in learning more about how Track & Know tools can help achieve medical service optimization.

Reflections on the Track & Know Mid Term Event

As part of the dissemination goals of the project, a mid-term event was held on 2nd May, 2019 in Leuven, Belgium as a special technical session with a reputed international conference on Ambient Systems, Network and Technologies (ANT) to gain attention of a wider and more related audience. This annual conference is a leading international conference for researchers and industry practitioners to share their new ideas, original research results and practical development experiences from Big Data analytics, cloud computing, emerging networking, tracking and sensing technologies, modelling simulation and transportation sciences, internet of things, etc.

1. Dr. Ibad Kureshi from Inlecom System (replacing Athanasios Koumparos - Vodafone Innovus) presented a Fleet management pilot of the Track & Know project and highlighted the current progress made in relation to toolbox development to answer relevant business questions. For example: 1) enrichment of trajectory data with weather, holidays and geographical point-of-interest (such as fuel station) to give more context for accident prediction analysis; 2) identification of traffic hot spots and then indication of alternatives routes. Please click here for more details.

2. Dr. Muhammad Adnan from UHasselt (replacing Feng Liu - UHasselt) presented details of the method for identifying traffic congestion hot spots using trajectory data and how alternative routes can be obtained using this technique. Some preliminary results on the approach are also presented by applying trajectory data of fleet from Vodafone Innovus. Please click here for more details.

The ANT conference is held from 29th April to 2nd May, 2019 as a special technical session. It is attended by more than 150 individuals from all continents of the world with presentations on just over 100 research papers. Apart from the dissemination of project results, the conference provided an excellent opportunity for enhancing the network and reach out to the researchers/practitioners in different but related domains by advertising the project portfolio and distributing the project materials (i.e. newsletter/flyers).

The special session on Track & Know project consisted of five key presentations of which the first presentation was an overall introduction to the Track & Know project, followed by four key technical presentations that described preliminary results and work in progress. This special session was well attended and generated some useful discussions on all presentations. The following paragraphs provide highlights of each technical presentation.

3. Mr. Kieran Lee from Royal Papworth Hospital- NHS presented details of the health pilot of the Track&Know project and highlighted current progress in relation to data characteristics analysis and relevant developments in the Track&know toolboxes. The presentation also highlight on finding the optimal number of exchange facilities (mobile outreach clinics) to minimize travel distances of Obstructive Sleep Apnoea (OSA) patients. Please click here for more details.

4. Prof. Mirco Nanni from CNR presented details of the Insurance pilot of the Track & Know project and highlighted the current progress in relation to analytical toolbox development to answer relevant business questions. The presentation also discusses some results from the preliminary analysis such as machine learning model estimation for accident prediction using the data obtained from Sistematica, Use of individual mobility network approach with some contextual information to characterize driver behaviour and cities to enhance model predictions. Please click here for more details.

Some key takeaways from the discussions with participants that help exploit project research activities are as follows:
1) Collaborations with Track & Know partners in further exploration of a variety of big data analysis methods;
2) Sharing and availability of data (aggregate data) for testing and resolving other pertinent research questions;
3) Knowledge sharing in relation to understand how Track & Know has resolved data privacy, GDPR and other ethical issues.

Key Liaison Activities, Workshops and Conferences

Big Data Value Forum Workshop on 'Policy issues, opportunities and barriers in big data-driven transport'

Track & Know has planned for clustering and knowledge transfer activities with the ICT-15 lighthouse projects Transforming Transport (TT), DataBio, e-SIDES others. In relation to this Track & Know took part in the Big Data Value Association (BDVA) workshops at the 2018 Big Data Value Forum (BDVF) in Vienna, Austria on Wednesday 14th November 2018. At a workshop, focused on challenges in Policy arranged by the Transforming Transport (TT) project, Track & Know provided a different voice using our unique case studies of Insurance, Driver Behaviour and Medical Services. The presentation and subsequent discussion included steps to identify barriers and opportunities in regulation to facilitate growth in car-pooling and EV vehicle adoption, as well as the use of mobility in a broader context to affect policy and organisational change. Please click here for more information.

E-sides Workshop on 'Towards Value-Centric Big data: Connect People, Proceses and Technologies'

The workshop was held on April 2nd, 2019 in Brussels, at the IMEC/BDVA venue (at the Vrije Universiteit) with an aim to gather all actors whose work and active engagement can promote responsible research and innovation in data the field of Big Data paving the way to design and deploy the next generation of Big Data solutions. Track & Know advocated the case of responsible research in relation to analytics when dealing with personal and personalised mobility by showcasing the development of a software framework that aims at increasing the efficiency of Big Data applications in the transport, mobility, motor insurance and health sectors. The discussion emphasized on the identification of biases created by historical series of person movements and test them through ethical and informed processes. In addition ensuring personal data protection and informed consent (e.g. in the health use cases) through appropriate staff training techniques. Please click here for more information. In relation to that workshop, E-side has also published a full report. Please click here to get the full report.

Stakeholder Workshops/Webinars on Medical Service Optimization

A series of two workshop (face-to-face) and webinar was held on 4th December, 2018 and 12th December, 2018 in relation to health pilot of Track & Know project. The aim of the workshop is to engage with the health relevant stakeholder, get them aware of the project plans, health pilot business case and questions address via bigdata toolboxes and type of data used to understand the problem.

Stakeholders involved/invited in the workshops are Respiratory Physicians from First People's Hospital Changzhou China, West China Medical School, Hospital of Sichuan University China, Sino-Health International Business Company, Sleep Apnoea trust association, Home sleep motor manufacturer, British Thoracic Society, Strawood Scientific, OSA partnership group, Cambridge and Peterborough Clinical Commissioning Group and Linguamatics: Data mining software company.

Stakeholders feedback were positive as they see the project in the UK as very beneficial. In China there is great interest in OSA service development and participation in joint research. No further data requirements were suggested, however it was proposed to examine relationship with other medical conditions, such as diabetes in OSA sufferers and look at service optimisation to join the outreach attendances of the two conditions. A plan has been proposed for the project to provide education to other stakeholders in the UK, as well as to use the project results for revision of the other OSA centre service flows. Workshop material can be accessed here.

Participation in 4th Annual Nursing, Midwifery and Allied Health Professional Research Conference

On the 14th of May, 2019 Mr. Kieran Lee, a research practitioner at Royal Papworth Hospital, presented a talk based on work being completed in health pilot at the 4th Annual Nursing, Midwifery and Allied Health Professional Research Conference. Attendees were mostly made up of staff from one of the Cambridge University Hospitals, but also many others working in health care from all other the UK. The Track & Know health pilot talk, was well received with wide agreement about the poor road network and almost non-existent public transport in the East of England. As well as offering encouragement for any work that makes health services more assessable and feeding back that the use of pharmacies as test pick up sites will be extremely convenient as lots of people already routinely visit such places as part of their weekly schedule. Please click here for more information.

Track & Know

PROJECT
NEWSLETTER

Track & Know | Issue 5 | Date: February 2020

WELCOME TO THE FIFTH TRACK & KNOW NEWSLETTER!

In this newsletter, you can find:

- A look back at what we have achieved in 2019
- A flash forward to the upcoming Summer School on Data Science for Mobility, supported by Track & Know
- A closer look at the Weather Integrator software
- An update on recent publications & dissemination activities
- We put our project video in the spotlight

ABOUT THE NEWSLETTER

This newsletter provides an update on the results and activities of the EU H2020 research project Track & Know. The aim is to ensure that those interested in managing big data are kept up to date with our latest developments, specifically mobility data and the tools/methods we develop to handle, analyse and visualize these datasets. Track & Know aims to answer industry generated questions in 3 test pilots in the transport/mobility, insurance and health care sectors. The business cases explored in these pilots centre on answering questions around minimizing patients travel, carpooling and electric mobility potential and driver behaviour profiling.

Project coordinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

First International Summer School on Data Science for Mobility

About

The objective of the **First International Summer School on Data Science for Mobility**, supported by Track & Know, is to offer to participants both visionary keynote speeches and hands-on mini courses.

Aim of the school

Massive amounts of spatio-temporal data, representing trajectories of moving objects are produced by an ever-increasing number of diverse, real-life applications, ranging from mobile to social media apps and surveillance systems, from vehicle tracking systems to IoT mobile sensors.

Target groups

This Summer School is intended for PhD students, researchers and practitioners in the fields of Computer and Information Science, interested in learning about the most recent developments in mobility data science.

Course aim

At the end of the course, each attendee will:

- Understand how to analyse mobility data with deep learning techniques
- Understand how machine learning and AI methods can be tailored to mobility data
- Understand how to manage Big Mobility Data
- Gain significant hands-on experience with state-of-the-art technologies and tools
- Have a vision of open research as well as technological challenges customized to key application areas and domains

FIRST INTERNATIONAL SUMMER SCHOOL ON
DATA SCIENCE FOR MOBILITY
April 27 - May 1, 2020

[Click here for full info and registration]

Key Dissemination and Liaison Activities

Track & Know presented at annual EU Big Data Value Forum in Helsinki

Prof. Yannis Theodoridis and Dr Ibad Kureshi represented the Track & Know project at the EU Big Data Value Forum, held from 14th to 16th October in Helsinki (Finland).

Pic. 2: Dr. Ibad Kureshi at the EU Big Data Value Forum in Helsinki (Finland)

Track & Know health pilot update presented at British Sleep Society conference

At the recent Bi-Annual British Sleep Society conference in Birmingham (UK), Kieran Lee from the Royal Papworth Hospital presented a poster on going work in pilot study 2.
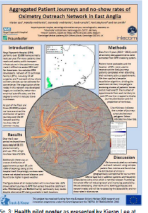
Pic. 3: Health pilot poster as presented by Kieran Lee at the Bi-Annual British Sleep Society conference in Birmingham (UK)

Weather Integrator Software

A software module within the Big Data Processing (BDP) Toolbox

In the Track & Know project, positional data of moving vehicles are further enriched with a variety of information.

Software Details and Features

This software provides a mechanism for enriching spatio-temporal point records (records that contain longitude, latitude and date information) with weather data.

Fig. 3: Map with trace information of a moving vehicle, enriched with several weather attributes

[Download this software via the online Track & Know observatory]

What have we achieved in 2019?

As published on the Big Data Value website - Author: Jenny Rainbird, Inlecom Systems

As Track&Know enters the final year of research and development, we look back over 2019 at what we have achieved.
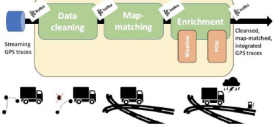
Fig. 1: The data cleaning and enrichment pipeline developed in Track & Know for online processing and enrichment of streaming GPS traces.

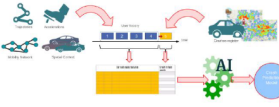The Big Data Analytics tool, is a crash prediction tool which can be used to assess the risk of an individual accident.

Fig. 2: The Track & Know process for predicting crash risks. Prediction models are built out of raw mobility traces through AI- and Mobility Analytics-based processes.

Pic. 1: Track & Know 'Speed dating workshop' Hasselt University, November 2019

PUBLICATIONS 2019 - 2020

- Nikitopoulos P., Sfyris G. A., Vlachou A., Doulkeridis C., Telelis O. (2019) Parallel and Distributed Processing of Reverse Top-k Queries, in Proceedings of the 35th IEEE International Conference on Data Engineering (ICDE 2019). Download here.
- Andrienko N., Andrienko G., Garcia J. M. C., Scarlatti D. (2019) Analysis of Flight Variability: a Systematic Approach, IEEE Transactions on Visualization and Computer Graphics, vol. 25(1), pp.54-64. Download here.
- Llao S., Andrienko G., Wu Y., Cao N., Jiang L., Shi C., Wang Y. S., Hong S. (2019) Steering Data Quality with Visual Analytics: the Complexity Challenge. Visual Informatics, vol 2(4), pp.191-197. Download here.
- Koutroumanis N., Santipantakis G., Glenis A., Doulkeridis C., Vouros G. (2019) Integration of Mobility Data with Weather Information, in Proceedings of International Workshop on Big Mobility Data Analytics (BMDA'19), Lisbon, Portugal, March 26, 2019. Download here.
- Guidotti, R, Monreale A, Cariggi L. (2019), Investigating Neighborhood Generation Methods for Explanations of Obscure Image-Classifiers, in: Yang Q, Zhou ZH., Gong Z., Zhang ML., Huang SJ. (eds) Advances in Knowledge Discovery and Data Mining. PAKDD 2019. Lecture Notes in Computer Science, vol 11439. Springer, Cham. Download here.
- Chen S., Andrienko G., Andrienko N., Doulkeridis C., Koumparos A., (2019) Contextualized Analysis of Movement Events, in: T. V. Landesberger and C.Turkay (Eds) EuroVis Workshop on Visual Analytics (EuroVA), pp. 49-53. The Europraphics Association. ISBN: 978-3-03868-087-1, DOI: 10.2312/eurova.20191124. Download here. (This publication received the 'EUROVA 2019 best paper award')
- Koutroumanis N., Nikitopoulos P., Vlachou A., Doulkeridis C. (2019), NoDA: Unified NoSQL Data Access Operators for Mobility Data, in Proceedings of the 16th International Symposium on Spatial and Temporal Databases (SSTD'19). Download here.
- Tsilionis E., Koutroumanis N., Nikitopoulos P., Doulkeridis C., Artikis A. (2019): Online Event Recognition from Moving Vehicle, in Proceedings of the 35th International Conference on Logic Programming (ICLP'19). Download here.
- Nanni, M., Longhi, L. (2019): Vehicle mobility data analysis and Individual Mobility Networks for crash prediction. Journal of Ambient Intelligence and Humanized Computing. DOI: https://doi.org/10.1007/s12652-019-01632-4 Download here.
- Adnan, M, Gozzler U., Yazar A. H., Bellemans T., Kureshi, I. (2020), Estimation of travel time distributions for urban roads using GPS trajectories of vehicles: a case of Athens, Greece, Personal and Ubiquitous Computing, DOI: https://doi.org/10.1007/s00779-020-01359-6. Download here.
- Theodoridis Y. (2020) Learning from Our Movements – The Mobility Data Analytics Era. In: Tserpes K., Renso C., Matwin S. (eds) Multiple-Aspect Discovery of Semantic Trajectories. MASTER 2019. Lecture Notes in Computer Science, vol 11889. Springer, Cham. Download here.

Track & Know

PROJECT
NEWSLETTER

Track & Know | Issue 6 | Date: May 2020

WELCOME TO THE SIXTH TRACK & KNOW NEWSLETTER!

In this newsletter, you can find:

- NoDa: a recent development
- Update on the upcoming Summer School on Data Science for Mobility, supported by Track & Know
- 5 new software additions to the online observatory
- Find out what the Track & Know Health Care and Fleet Management pilots are about

ABOUT THE NEWSLETTER

This newsletter provides an update on the results and activities of the EU H2020 research project Track & Know. The aim is to ensure that those interested in managing big data are kept up to date with our latest developments, specifically mobility data and the tools/methods we develop to handle, analyse and visualize these datasets. Track & Know aims to answer industry generated questions in 3 test pilots in the transport/mobility, insurance and health care sectors. The business cases explored in these pilots centre on answering questions around minimizing patients travel, carpooling and electric mobility potential and driver behaviour profiling.

Project coordinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

5 new software additions to the online observatory
(all part of the BDP tool box)

1. Distributed Subtrajectory Clustering

2. Run-Time Event Calculus

3. Distributed Subtrajectory Join

4. Distributed Subtrajectory Similarity Matrix

5. Online Relational Learning

Download this software via the online Track & Know observatory

NoDA: a recent development within Track & Know

Fig. 1: The vision of NoDa in Track & Know.

Postponed: First International Summer School on Data Science for Mobility

Track & Know Fleet Management Pilot

Track & Know Health Care Pilot

Track & Know

PROJECT
NEWSLETTER

Track & Know | Issue 7 | Date: October 2020

WELCOME TO THE SEVENTH TRACK & KNOW NEWSLETTER!

In this newsletter, you can find:

- Big Data Analytics toolbox: recent updates
  - Simulation of electric vehicles mobility using individual
    - mobility network
  - Hotspot analysis
  - Driver behaviour profiling
  - Identifying business activity-travel patterns based on
    - GPS data
- T&K Dashboards
- Updates on the Track & Know test pilots
- Book release

Project coordinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40
1000 Brussels
Belgium
Ibad.kureshi@inlecomsystems.com

ABOUT THE NEWSLETTER

This newsletter informs you about the results and activities of the EU H2020 research project Track& Know. The aim is to keep all relevant actors interested in managing big data, more specifically in the type of big data we focus on in the project and the tools/methods we develop to handle, analyse and visualize these datasets. T&K focuses on resolving key business cases for 3 test pilots, namely transport/mobility, insurance and health care. Business cases which will be explored in these pilots are as follows but not limited to: minimizing patients travel, carpooling and electric mobility potential, driver behaviour profiling etc.

Big Data Pilot Demo Days

Book release

Identifying business activity-travel patterns based on GPS data - UHASSELT, Belgium

T&K Dashboards – UZH, Switzerland

Simulation of Electric Vehicles mobility and Individual mobility Networks - CNR (Italy)

Identify driving patterns and categorize driving behaviour on-the-fly based on trajectory dynamics - UPRC, Greece
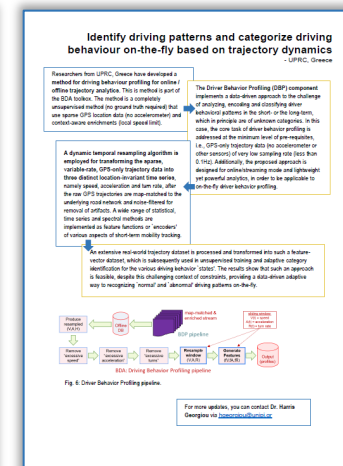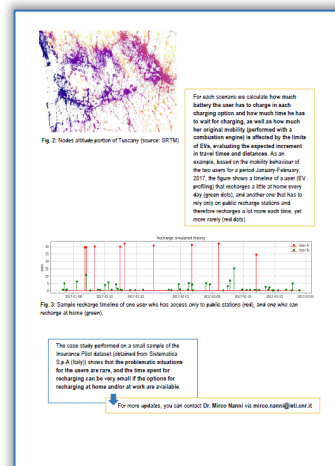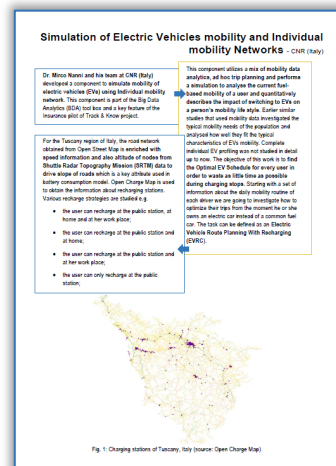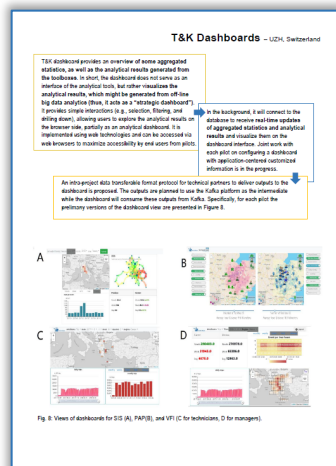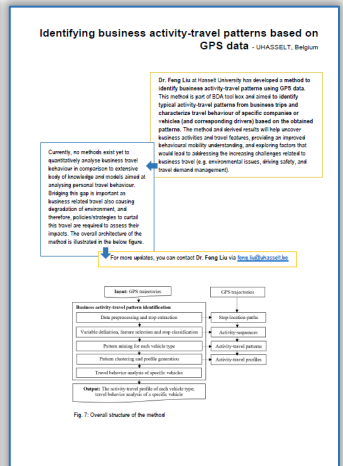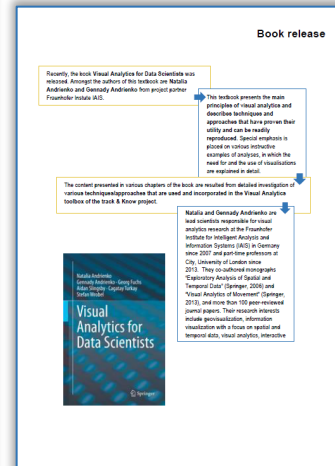
Each newsletter was also sent out via Mailchimp to **92 users** that subscribed to the mailinglist. (example below)

View this email in your browser

Track & Know

Track & Know - Newsletter - October 2020
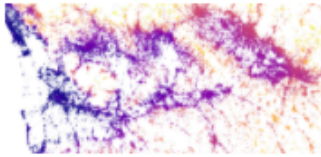
Simulation of Electric Vehicles mobility and Individual Mobility Networks

Dr. Mirco Nanni and his team at CNR (Italy) developed a component to simulate mobility of electric vehicles (EVs) using Individual mobility network. This component is part of the Big Data Analytics (BDA) tool box and a key feature of the Insurance pilot of Track & Know project. **>> Read more**

Hot Spot Analysis

Researchers from **UPRC**, Greece have developed a method for Hot-Spot analysis with a view point that previous methods are based on spatiotemporal point data, not trajectories (sequences of points), and also parallel algorithms are designed and implemented in Apache Spark so they scale gracefully for Big Data. **>> Read more**
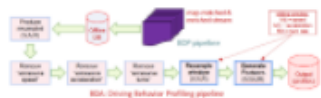
Identifying driving patterns and categorizing behaviour on-the-fly based on trajectory dynamics

Researchers from **UPRC**, Greece have developed a method for driving behaviour profiling for online / offline trajectory analytics. This is method is part of the **BDA toolbox**. The method is a completely unsupervised method (no ground truth required) that use sparse GPS location data (no accelerometer) and context-aware enrichments (local speed limit). **>> Read more**
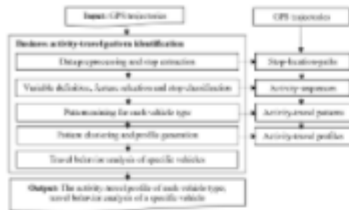
Identifying business activity-travel patterns based on GPS data

Dr. Feng Liu at Hasselt University has developed a method to identify business activity-travel patterns using GPS data. This method is **part of BDA tool box** and aimed to identify typical activity-travel patterns from business trips and characterize travel behaviour of specific companies or vehicles (and corresponding drivers) based on the obtained patterns. **>> Read more**

Track & Know dashboards

T&K dashboard provides an **overview of some aggregated statistics, as well as the analytical results generated from the toolboxes.** In short, the dashboard does not serve as an interface of the analytical tools, but rather visualizes the analytical results, which might be generated from off-line big data analytics (thus, it acts as a "strategic dashboard"). **>> Read more**

Big Data Pilot Demo Days

The new data-driven industrial revolution highlights the need for big data technologies to unlock the potential in various application domains. To this end, BDV PPP projects I-BiDaaS, BigDataStack, Track & Know and Policy Cloud deliver innovative technologies to address the emerging needs of data operations and applications. **>> Read more**
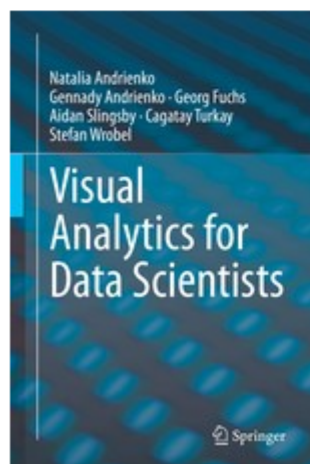
Book release

Recently, the book **Visual Analytics for Data Scientists** was released. Amongst the authors of this textbook are **Natalia Andrienko and Gennady Andrienko** from project partner **Fraunhofer Instute IAIS**. **>> Read more**

Publications 2018-2019-2020

Discover the latest publications from the Track & Know consortium partners. >> Read more

Click here to read the full issue online!

This email was sent to << Test Email Address >>
why did I get this?   unsubscribe from this list   update subscription preferences
Hasselt University - IMOB (partner in Track & Know) · Wetenschapspark 5 bus 6 · Diepenbeek 3590 · Belgium

mailchimp

Annex 5: Popular publications – overview & examples

Source	Date	Title	URL
Hasselt University & IMOB website	Jul-18	EU-project Track & Know verhoogt efficiëntie van Big Data-applicaties.	go to article
Hasselt University & IMOB website	Jul-18	EU project Track&Know increases the efficiency of Big Data applications in transport, mobility, motor insurance and health sectors.	go to article
CNR website	Sep-18	Track&Know: applicazioni di big data più efficienti per trasporti, mobilità, salute e assicurazioni auto.	go to article
CNR website	Sep-18	Track&Know: Big Data applications in transport, mobility, motor insurance and health sectors.	go to article
Hasselt University	Jun-19	Track&Know: Big Data for Mobility Tracking, Knowledge extraction in urban areas.	see flyer
Respiratory Futures Podcast	Jun-19	Podcast: Preliminary Screening For Obstructive Sleep Apnoea In Prmary Care – Why Do It?	go to podcast
OSA Partnership Group	Jun-19	Podcast: Preliminary Screening For Obstructive Sleep Apnoea In Prmary Care – Why Do It?	go to podcast
European Dissemination Media Agency	Mar-20	Track&Know: Big Data for Mobility Tracking, Knowledge extraction in urban areas.	go to article
ITV Anglia	Mar-20	News item about the health pilot	watch here
Research Information	Jul-20	Real-life problems and big data solutions.	go to article
Scientific Computing World	Jul-20	Real-life problems and big data solutions.	go to article
University of Pireaus - Dept of Digital Systems	Sep-20	The article of the month: Big Data Processing in NoSQL Systems	go to article
BigDataStack, I-BiDaas, T&K	Dec-20	Joint sessions EBDVF 2020 Report: (DOI 10.5281/zenodo.4326876)	go to report
European Dissemination Media Agency	Jan-21	Overview 4-page article	upcoming
SIGMOD Record	Jan-21	A Survey on Big Data Processing Frameworks for Mobility Analytics	upcoming

Example: "Real-life problems and big data solutions." (Research information)

Research information

Real-life problems and big data solutions

1 July 2020

Our Researcher of the Month for July is **Ian Smith**, of Cambridge's Royal Papworth Hospital.

Reducing traffic to and from medical facilities – and examining driving behaviour among those with sleep problems – are the subject of ongoing high-level complex research across Europe.

Ian Smith heads up the sleep service at Cambridge's Royal Papworth Hospital in the UK, which is contributing health care data to a project called Track and Know, aimed at bringing big data solutions to real-life geospatial problems.

Royal Papworth accepts referrals from across the East of England; an area of some 19,000 square kilometres, with around 20,000 patients being seen each year. The population of the region is thinly spread, with an average density of 310 people per square kilometre – compared, for example, to more than 1,500 in London.

Smith told *Research Information*: 'We often need to arrange sleep studies for patients at home that would require several trips to and from the hospital, which would add up to journeys of as much as 400km for some people. The solution has been to develop a network of outreach facilities over the last 10 years to improve accessibility, but these have been situated as best guesses to serve our referred population. At the peak we had 23 facilities and the average journey was 35 km.

Through the project the team – a mix of 14 university and commercial partners from 10 countries ranged across the EU – has analysed 46,211 historical patient journeys and modelled the most efficient network.

Smith continued: 'The model shows that we can provide the service most efficiently with just 10 clinics and reduce the average journey to 17km, saving up to 30 tonnes of CO_2 emissions a year.

'We have looked further into our referral base by the socio-economic status of the areas from which patients are referred; we would anticipate more sleep illness in areas with social deprivation related to poor employment opportunities, increasing rates of obesity, and increased numbers of older residents.

'However we have had fewer referrals from these areas, when patients do attend they are more unwell and a higher proportion of patients fail to attend their appointments. We also now know that more people miss their appointments when it is sunny than when it is raining! We are re-running these high-level, complex models to see if we can make journeys particularly easy for people referred from areas that are socio-economically challenged.'

Driving knowledge

The team is also working on a sub-project that examines driving behaviour among those with sleep disorders.

Smith said: 'We know that people with sleep disorders are more likely to crash their cars than people with good sleep, maybe four times more likely, and it also seems likely that shift workers are also at risk. However there are currently no good measures of who is at risk and who is safe.'

Accordingly, the team is developing a mobile phone app to measure driving behaviour, and is currently monitoring the driving of staff at the hospital who work a mix of day and night shifts. It will soon start monitoring patients with sleep illnesses before and after treatment as they drive around the East of England region.

Smith said: 'The plan is to use the app to alert people when their driving performance is drifting. In future, it should be able to help adjudicate on whether or not people can return to driving when they have had a sleep illness – the aim is to contribute to an improvement in road safety, and also getting people back to work as soon as it is appropriate. Other use cases for the whole Track and Know platform include looking at insurance models based on driving behaviour, and fleet management – predicting journeys and efficient distribution of resources.

'The data analysis teams have built the Track and Know platform to accept a broad range of data types and allow for rapid processing of 'big data' integrating driver behaviour with local road conditions, weather patterns, distribution of retail outlets, petrol stations, electrical charging points, weight of traffic, known accident black spots, and so on.'

The study is funded from an EU 2020 grant of 4.8 million euros, and all publications relating to the research are required to be open – they can be found at https://trackandknowproject.eu/publications/. Furthermore, many of the models and algorithms are based on the EU Track and Know project, where some of the data and models are public: https://trackandknowproject.eu/file-repository/

Smith concluded: 'National Health Service journeys account for around five per cent of traffic on our roads, so obviously if we can reduce this we can have a major impact on road congestion and CO_2 emissions. In the era of Covid there is an increasing premium attached to reducing travel and visits to health care facilities unless absolutely necessary. Sleepiness is now a bigger problem for road safety than alcohol, so identifying sleepy drivers is a key priority and a simple phone app could give drivers their own safety profile.

'Replanning services throughout the NHS may help clear backlogs caused by the lockdown, and better match supply and demand in the coming years. On the back of the current work, a sub-group from Track and Know has been awarded a grant from Innovate UK to address exactly this challenge. Watch this space!'

Ian Smith is a consultant physician, and deputy medical director and director of research and development at Royal Papworth Hospital. *Interview by Tim Gillett* ***Do you know anyone who deserves to be our Researcher of the Month? Let us know!***

other tags: COVID-19, BIG DATA, RESEARCHER OF THE MONTH,

company: ROYAL PAPWORTH HOSPITAL, TRACK AND KNOW

Example: "The article of the month: Big Data Processing in NoSQL Systems." (University of Pireaus – Dept of Digital Systems)

Big Data Processing in NoSQL Systems

SEPTEMBER 21, 2020

Christos Doulkeridis

Associate Professor

Researchers from the Department of Digital Systems propose a novel method for unified data access to NoSQL stores.

Even though NoSQL stores (MongoDB, CouchDB, HBase, Cassandra, Redis, etc.) comprise the state-of-the-art technology for Big Data management, they still rely on different languages and programming APIs, thus hindering application development.

A novel method for unifying NoSQL storage systems for big data developers

In plain terms, NoDA is a programming API (see the blue layer at the right part of the figure) that consists of basic data access operators (such as filter, project, aggregate, sort), which are implemented for each NoSQL system separately, thus offering a simple and familiar language to the big data developer in order to implement applications, with the following advantages:

«Simple idea, yet very useful» [External reviewer]

- It is simple to use and easy to learn, as it hides the peculiarities of each NoSQL system.
- It is unified, thus allowing code portability from one NoSQL system to the other, in the same spirit as in relational databases.
- It offers additionally a declarative, SQL-like interface, which makes it more user-friendly both for big data developers and data analysts.

This research work is carried out by PhD student Nikolaos Koutroumanis, supervised by Associate Professor Christos Doulkeridis.

More information:

- Paper:
  https://www.ds.unipi.gr/prof/cdoulk/papers/sstd19a.pdf
- Short video (teaser): https://www.youtube.com/watch?v=Rf6OYWP6lic
- Research project Track&Know:
  https://trackandknowproject.eu/
- General information on NoSQL systems:
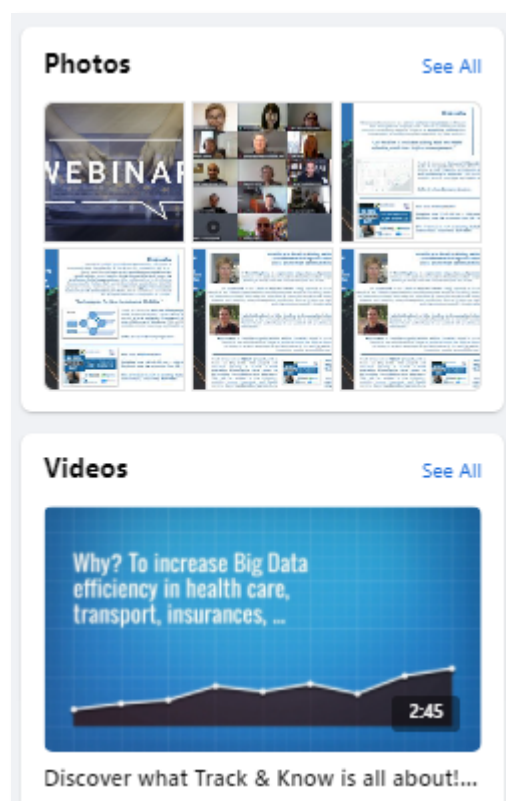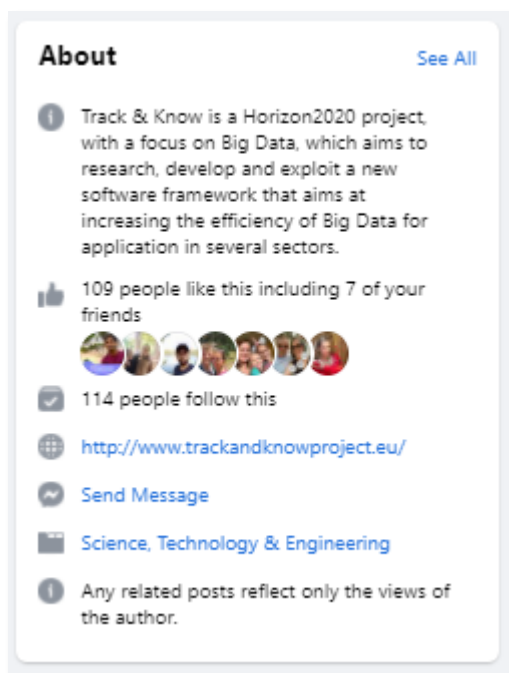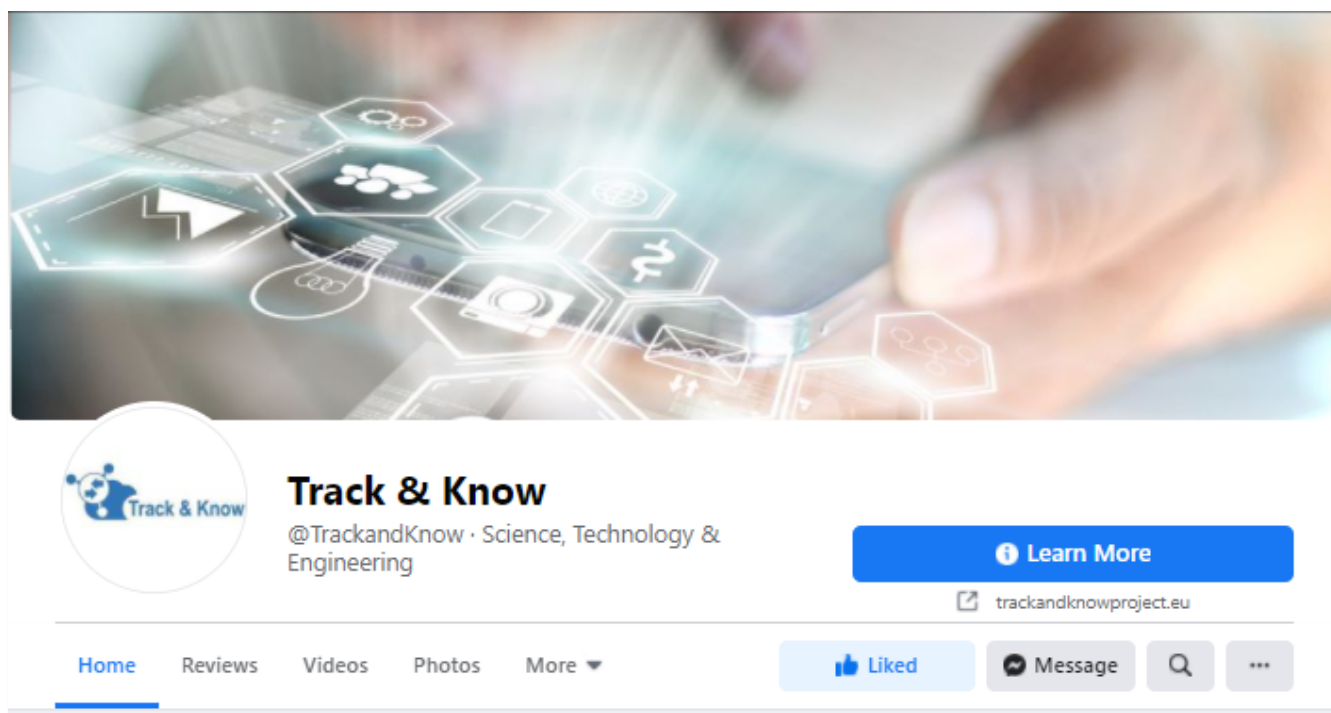 https://dl.acm.org/doi/10.1145/3158661

ΔΗΜΟΣΙΕΥΘΗΚΕ ΣΤΟ HIGHLIGHTS (EN)

Example: "European Big Data Research for Industry – 3 projects, 7 sectors, 9 applications, 41 software components. Now what? – report

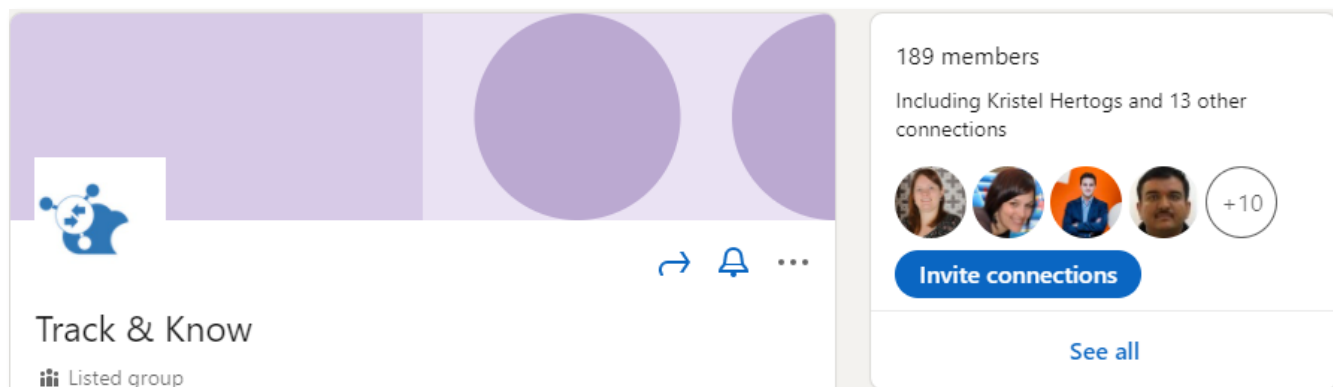## Annex 6: Social media (screenshots)

- **Facebook page**

- **Twitter account**

- **LinkedIn group**

Annex 7: Press releases

Track & Know

Persbericht UHasselt – 10 juli 2018

EU-project Track & Know verhoogt efficiëntie van Big Data-applicaties.

Instituut voor Mobiliteit (IMOB) ontwikkelt toolbox om big-datagegevens te visualiseren.

Track & Know krijgt financiering van het onderzoeks- en innovatieprogramma Horizon 2020 van de Europese Unie. Het consortium van 14 partners uit 9 verschillende landen ging in januari van start. Sindsdien heeft een team van toponderzoekers en vertegenwoordigers van de industrie een vliegende start gemaakt. Dit 3-jarig project focust op het onderzoeken, ontwikkelen en exploiteren van een nieuw softwarekader om de efficiëntie te verbeteren van Big Data-applicaties in de sectoren transport, mobiliteit, (motorvoertuigen)verzekering en gezondheidszorg. Daarnaast beoogt het project de ontwikkeling van gebruikersvriendelijke toolboxen voor de aangehaalde sectoren na een efficiëntiecontrole in realistische pilootprojecten.

IMOB-UHasselt is één van de onderzoekspartners in het project en is mee verantwoordelijk voor de ontwikkeling van methoden om Big Data te analyseren en visualiseren zodanig dat de gebruiker de data beter begrijpt. IMOB staat verder ook in voor de communicatie en de bredere verspreiding van de vorderingen van dit project.

Wat zijn Big Data?

We praten over Big Data bij het nemen van beslissingen met behulp van grote hoeveelheden gegevens die blijven toenemen. De omvang, verscheidenheid en snelheid van deze gegevens, maken opslag en verwerking ervan met traditionele database-en verwerkingssystemen onmogelijk. Sectoren zoals gezondheidszorg en transport hebben baat bij Big Data-verwerking door via deze data trends te identificeren die de kosten en de CO2-voetafdruk van verschillende diensten kunnen verlagen en de tevredenheid van de consument kunnen verbeteren. Via locatie gebonden gegevens die zijn verzameld door slimme apparaten (zoals auto's, black-boxen, medische controlesystemen) in combinatie met andere openbare en eigen datasets (bijvoorbeeld socio-demografische samenstellingen, omgevingssensoren, weerinformatie …) kunnen verschillende systemen en processen worden geoptimaliseerd.

Hoe zal Track&Know een verschil maken in de samenleving? Het Consortium Perspectief

Dr. Ibad Kureshi, Inlecom Systems (projectcoördinator): Track & Know ontwikkelt nieuwe technologieën en benaderingen met betrekking tot Big Data. Denk aan toepassingen in intelligente mobiliteitsdiensten; autonome, verbonden en gedeelde voertuigtechnologieën; gezondheidszorg; voorspellend onderhoud, financiën en verzekeringen … We ontwikkelen gebruiksvriendelijke toolboxen voor intelligente en geïntegreerde diensten om veiligheidsvoorspellingen te maken. Dit kan bijdragen tot het vermijden van botsingen, het optimaliseren van noodmaatregelen en -/ of het managen van ongevallen, het voorkomen van het achteruitgaan van rijvaardigheid, aanpasbare verzekeringsdiensten … Ons doel is om de wijze te veranderen waarop visualisatietechnieken gegevens toegankelijk maken op een manier die mensen begrijpen.

Prof. dr. Ansar Yasar, IMOB-UHasselt (project partner): "Het verbeteren van de efficiëntie en het

---

IMOB-UHasselt, nemen hier graag aan deel. Onze bijdrage richt zich voornamelijk op de ontwikkeling van een toolbox om tijd-ruimte gegevens te visualiseren en op de communicatie over de voortgang en realisaties van het project."

Toponderzoekers uit verschillende sectoren passen hun expertise toe op Big Data

Track & Know brengt interdisciplinaire partners uit de transport-, verzekerings- en gezondheidssector, de academische wereld en onderzoek samen met gebruikers en partners die gegevens verstrekken, gericht op echte en door de gebruiker gedefinieerde uitdagingen. Het complementaire onderzoeksteam heeft een bewezen staat van dienst en voert onderzoek uit van hoge kwaliteit. Binnen dit project combineren ze hun expertise om voor de markt relevante resultaten te behalen met een aanzienlijk exploitatiepotentieel. Prof. dr. Yannis Theodoridis, UPRC (onderzoekscentrum van de universiteit van Piraeus): "We pakken de problemen aan die voortvloeien uit het autovervoer in moderne grootstedelijke gebieden en vergroten het contextuele bewustzijn over stedelijke mobiliteit door intelligente informatie en voorspellende analyses te leveren aan gebruikersgroepen, belanghebbenden en stadsmanagers."

Meer informatie over het project: https:///trackandknowproject.eu

Contactpersoon voor meer infomatie:

Projectcoördinator

Dr. Ibad Kureshi
Senior Research Scien st – Inlecom Systems
Square de Meeus 38/40,
Brussels, 1000, Belgium
ibad.kureshi@inlecomsystems.com

IMOB-UHasselt projectleider

Prof. dr. Ansar Yasar
Instituut voor Mobiliteit (IMOB) – Universiteit Hasselt
Wetenschapspark 5 bus 6
3590 Diepenbeek
Ansar.yasar@uhasselt.be
GSM: +32 486 93 29 57

Track & Know

PRESS RELEASE HASSELT UNIVERSITY – June XX 2019

Track & Know reaches mid-term and engages in important liaison activities

The research project Track & Know, funded by the EU's Horizon 2020 research and innovation programme, draws near its upcoming mid-term. This marks an important milestone as it leaves the project consortium 18 months to achieve its goals. In preparation of the review, the consortium partners recently gathered for a mid-term event in Leuven (Belgium) to put the spotlight on their research and reach out to a broad audience. Also, the past months, several team members engaged in liaison conferences, workshops and webinars to get in touch with various relevant stakeholders.

The Track & Know consortium of 14 partners aims to research, develop and exploit a new software framework to increase efficiency of Big Data applications in transport, mobility, motor insurance and health sectors. Moreover, the project will develop user-friendly toolboxes that will be readily applicable in the addressed markets after efficiency validation in real-world pilots. The research project focuses on resolving key business cases for 3 test pilots, namely transport/mobility, insurance and health care. We talk about Big Data when processing and making decisions using large amounts of varied data that continues to grow. Known as the 3 V's of Big Data, these characteristics of Volume, Variety and Velocity make the storage and processing of this data unsuitable for traditional database and processing systems.

Mid-term event: special technical session at annual ANT-conference
As part of the dissemination goals of the 3-year project, a mid-term event was held as a special technical session within the reputed international conference on Ambient Systems, Network and Technologies (ANT). This session was meant to gain attention of a wider and more related audience. The 2019 ANT conference for researchers and industry practitioners took place in May and was attended by more than 150 individuals from all continents with presentations on over 100 research papers. The conference provided an excellent opportunity to enhance the network and reach out to the researchers and practitioners in different but related domains by advertising the project portfolio and distributing the project materials.

The well attended session on the Track & Know project consisted of five key presentations of which the first served as an overall introduction. The other technical presentations described preliminary results, work in progress and generated some useful discussions, that resulted in 3 key takeaways that will help exploit upcoming project research activities:

1) Collaborations with Track & Know partners in further exploration of a variety of big data analysis methods,
2) Sharing and availability of data (aggregate data) for testing and resolving other pertinent research questions,

---

3) Knowledge sharing in relation to understand how Track & Know has resolved data privacy, GDPR and other ethical issues.

Key liaison activities, workshops and conferences
In the past months, Track & Know project researchers participated in several key liaison activities. Attending these activities is highly important as it enables the consortium to present the project to researchers and practitioners, expand their network, create project, engage relevant stakeholders and disseminate current research results. These activities included the November 2018 Big Data Value Forum in Vienna (Austria), a collaboration visit to two hospitals in Wuhu China, the E-sides Workshop on 'Towards Value-Centric Big data: Connect People, Processes and Technologies' in Brussels and various other key activities.

More info on these activities and the related publications can be found in the third issue of the Track & Know online newsletter.

EU H2020 research project Track & Know
Track & Know is a 3-year project funded by the European Union's Horizon 2020 research and innovation programme. The consortium of 14 partners from 9 different countries kicked-off in January 2018. IMOB-UHasselt is one of the research partners and is responsible for developing visual analytics methods to analyse data (e.g. assessing data quality, identifying data patterns, building models that explain the data, visualize data…). Furthermore, IMOB coordinates the dissemination and communication activities in the project.

More information about the project can be found at: https:///trackandknowproject.eu
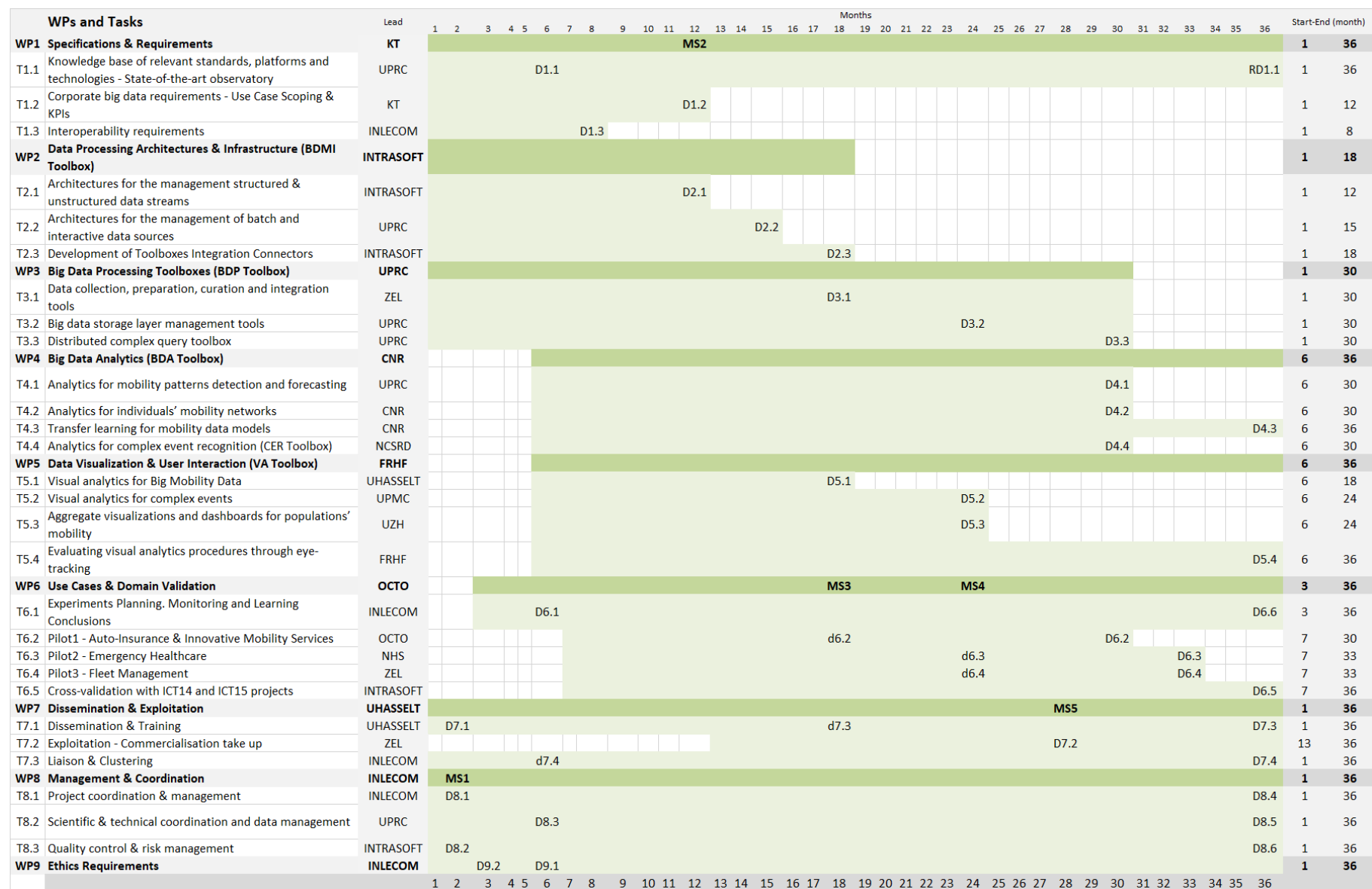Contact person for more information:

Project coördinator
Dr. Ibad Kureshi
Senior Research Scientist – Inlecom Systems
Square de Meeus 38/40,
Brussels, 1000, Belgium
ibad.kureshi@inlecomsystems.com

IMOB-UHasselt project leader
Prof. dr. Ansar Yasar
Instituut voor Mobiliteit (IMOB) – Universiteit Hasselt
Wetenschapspark 5 bus 6
3590 Diepenbeek
Ansar.yasar@uhasselt.be
GSM: +32 486 93 29 57

Annex 8: Gantt chart

	WPs and Tasks	Lead	Months (1–36) — deliverables/milestones	Start	End
WP1	Specifications & Requirements	KT	MS2	1	36
T1.1	Knowledge base of relevant standards, platforms and technologies - State-of-the-art observatory	UPRC	D1.1 … RD1.1	1	36
T1.2	Corporate big data requirements - Use Case Scoping & KPIs	KT	D1.2	1	12
T1.3	Interoperability requirements	INLECOM	D1.3	1	8
WP2	Data Processing Architectures & Infrastructure (BDMI Toolbox)	INTRASOFT		1	18
T2.1	Architectures for the management structured & unstructured data streams	INTRASOFT	D2.1	1	12
T2.2	Architectures for the management of batch and interactive data sources	UPRC	D2.2	1	15
T2.3	Development of Toolboxes Integration Connectors	INTRASOFT	D2.3	1	18
WP3	Big Data Processing Toolboxes (BDP Toolbox)	UPRC		1	30
T3.1	Data collection, preparation, curation and integration tools	ZEL	D3.1	1	30
T3.2	Big data storage layer management tools	UPRC	D3.2	1	30
T3.3	Distributed complex query toolbox	UPRC	D3.3	1	30
WP4	Big Data Analytics (BDA Toolbox)	CNR		6	36
T4.1	Analytics for mobility patterns detection and forecasting	UPRC	D4.1	6	30
T4.2	Analytics for individuals' mobility networks	CNR	D4.2	6	30
T4.3	Transfer learning for mobility data models	CNR	D4.3	6	36
T4.4	Analytics for complex event recognition (CER Toolbox)	NCSRD	D4.4	6	30
WP5	Data Visualization & User Interaction (VA Toolbox)	FRHF		6	36
T5.1	Visual analytics for Big Mobility Data	UHASSELT	D5.1	6	18
T5.2	Visual analytics for complex events	UPMC	D5.2	6	24
T5.3	Aggregate visualizations and dashboards for populations' mobility	UZH	D5.3	6	24
T5.4	Evaluating visual analytics procedures through eye-tracking	FRHF	D5.4	6	36
WP6	Use Cases & Domain Validation	OCTO	MS3 MS4	3	36
T6.1	Experiments Planning. Monitoring and Learning Conclusions	INLECOM	D6.1 … D6.6	3	36
T6.2	Pilot1 - Auto-Insurance & Innovative Mobility Services	OCTO	d6.2 … D6.2	7	30
T6.3	Pilot2 - Emergency Healthcare	NHS	d6.3 … D6.3	7	33
T6.4	Pilot3 - Fleet Management	ZEL	d6.4 … D6.4	7	33
T6.5	Cross-validation with ICT14 and ICT15 projects	INTRASOFT	D6.5	7	36
WP7	Dissemination & Exploitation	UHASSELT	MS5	1	36
T7.1	Dissemination & Training	UHASSELT	D7.1 … d7.3 … D7.3	1	36
T7.2	Exploitation - Commercialisation take up	ZEL	D7.2	13	36
T7.3	Liaison & Clustering	INLECOM	d7.4 … D7.4	1	36
WP8	Management & Coordination	INLECOM	MS1	1	36
T8.1	Project coordination & management	INLECOM	D8.1 … D8.4	1	36
T8.2	Scientific & technical coordination and data management	UPRC	D8.3 … D8.5	1	36
T8.3	Quality control & risk management	INTRASOFT	D8.2 … D8.6	1	36
WP9	Ethics Requirements	INLECOM	D9.2 D9.1	1	36

Annex 9: Google Analytics report on project website

- **Evolution page views per month (July 1st, 2019 – December 1st, 2020)**
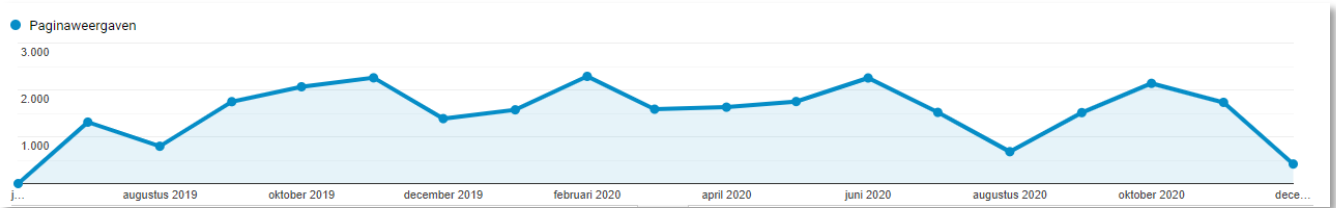
- **Evolution unique page views per month (July 1st, 2019 – December 1st, 2020)**
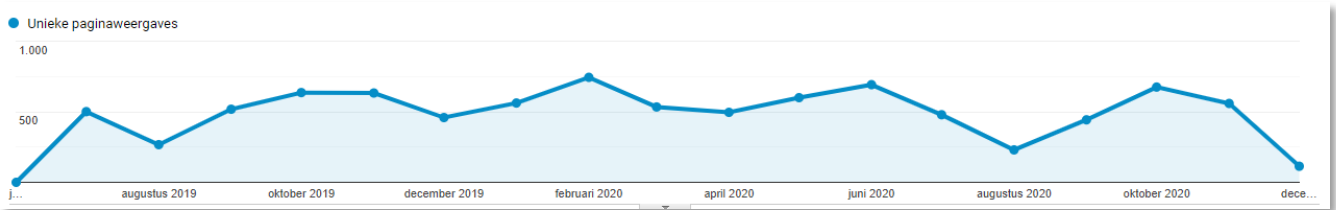
- **Overview of page views and unique page views (July 1st, 2019 – December 1st, 2020)**
  - Total of **28.668 page views** and **9.142 unique page views**
  - Home page was the most visited page, followed by the online observatory and the **consortium page**

Paginatitel	Paginaweergaven	Unieke paginaweergaves
	28.668 % van totaal: 100,00% (28.668)	9.142 % van totaal: 100,00% (9.142)
1. Track & Know |	7.713 (26,90%)	2.621 (28,67%)
2. Online observatory | Track & Know	4.934 (17,21%)	1.239 (13,55%)
3. Consortium | Track & Know	1.363 (4,75%)	388 (4,24%)
4. Scientific publications | Track & Know	862 (3,01%)	289 (3,16%)
5. About | Track & Know	807 (2,81%)	249 (2,72%)
6. Deliverables | Track & Know	735 (2,56%)	237 (2,59%)
7. Partners | Track & Know	653 (2,28%)	186 (2,03%)
8. Objectives | Track & Know	518 (1,81%)	167 (1,83%)
9. Publications | Track & Know	506 (1,77%)	136 (1,49%)
10. Projects | Track & Know	403 (1,41%)	129 (1,41%)

- **User overview**
  - 3K unique users
  - 4.6K sessions
  - Average duration per session: 2m30s
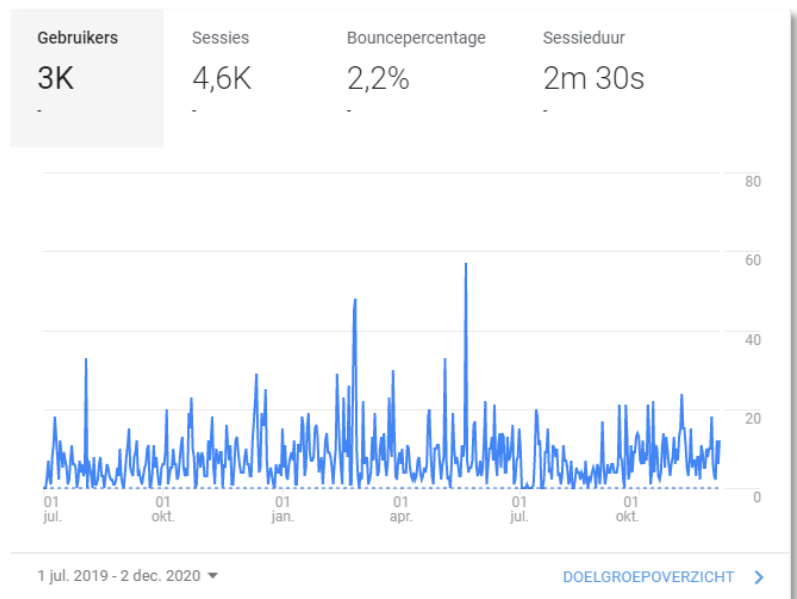
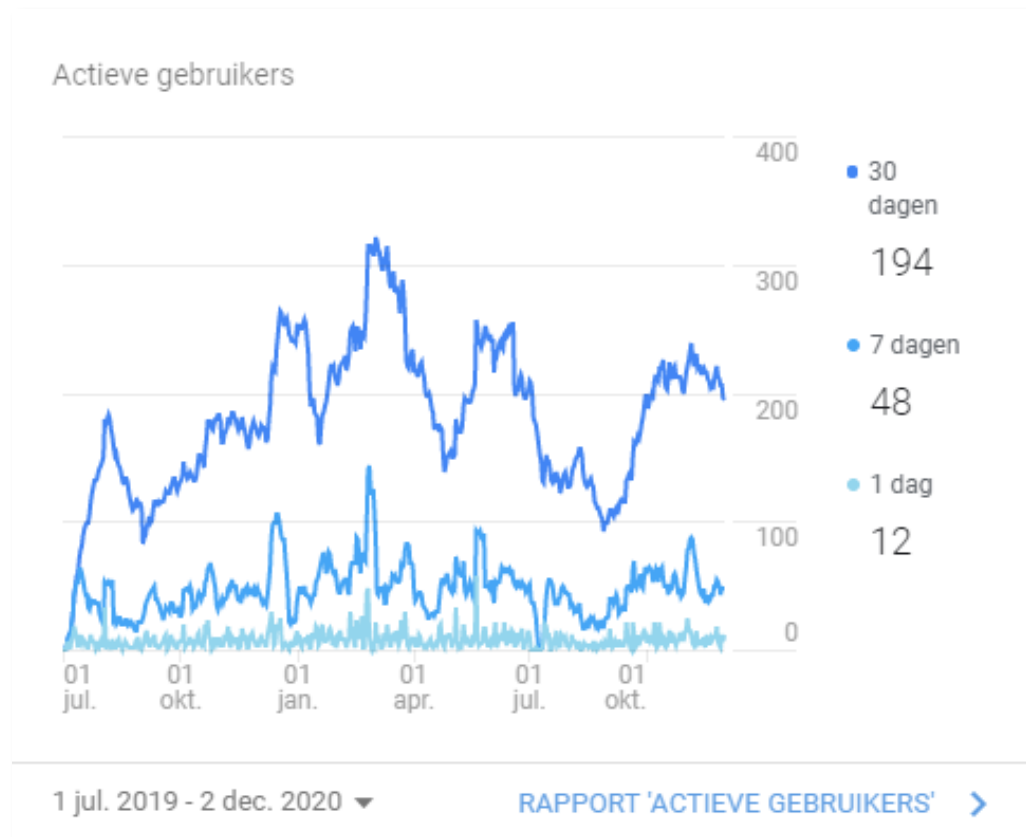- **Evolution number of users per month**
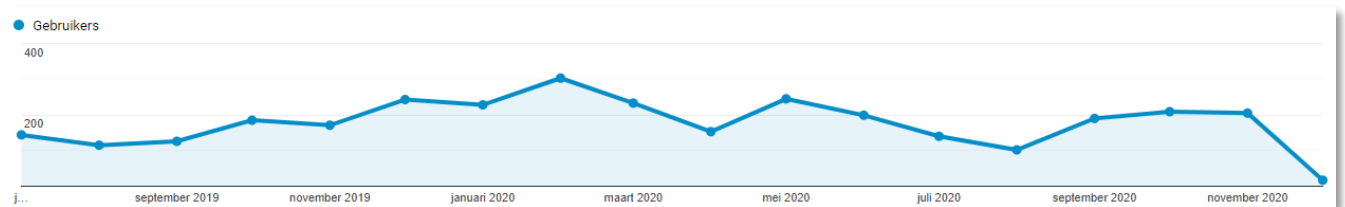
- **User details:**
  - **2.941 unique users**
  - **4.629 sessions** with an average of 1.5 sessions per user
  - **28.668 page views** with an average of 6.19 pages per session
  - Average session duration is **2m.31s**
  - Average bounce rate is 2,20%
  - Language: almost 65% of users spoke English (US and UK combined) – based on the computer settings of the users

Taal	Gebruikers	% Gebruikers
1. en-us	1.533	51,93%
2. en-gb	383	12,97%
3. el-gr	137	4,64%
4. it-it	107	3,62%
5. zh-cn	97	3,29%
6. fr-fr	63	2,13%
7. es-es	61	2,07%
8. en	55	1,86%
9. de-de	49	1,66%
10. nl-nl	41	1,39%

- **Evolution of active users per month**

- **Location of users and number of sessions per country**
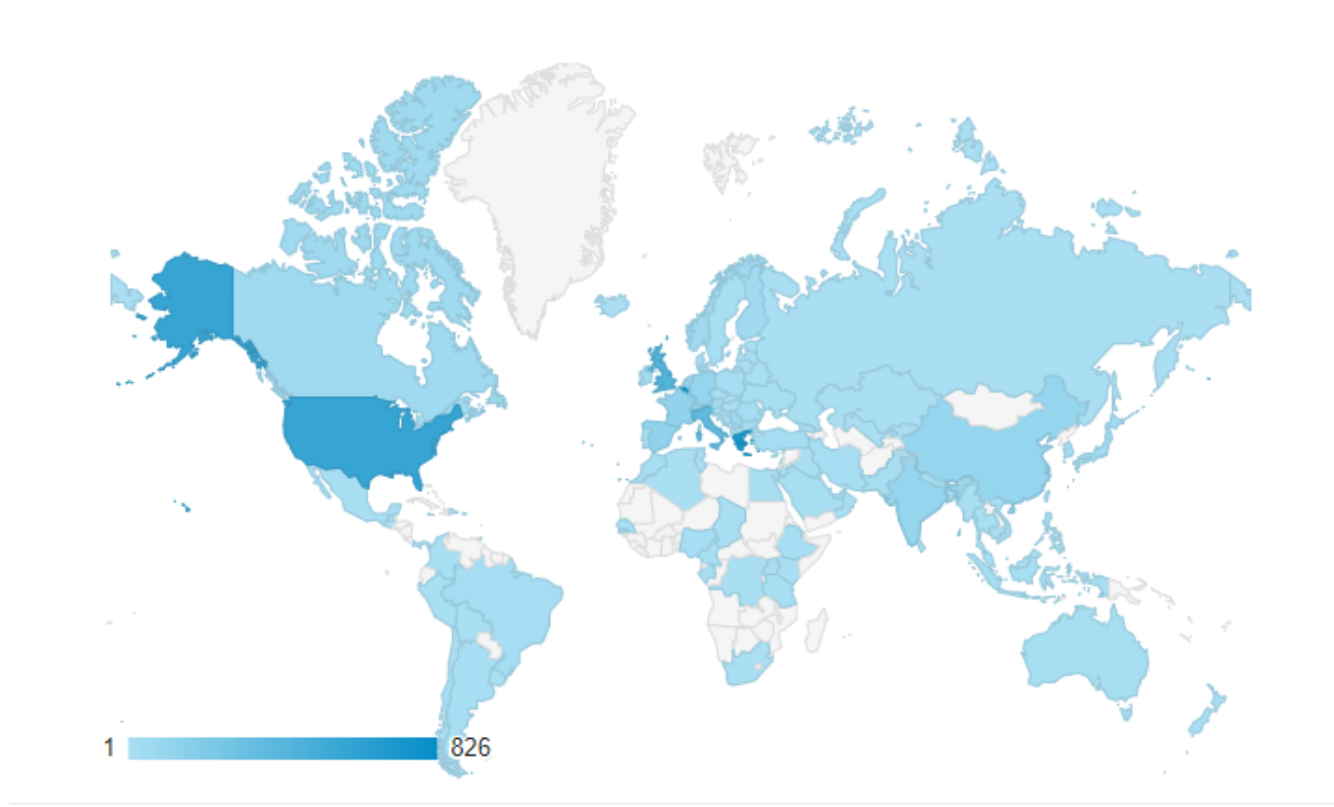
| Land	Acquisitie			Gedrag		
	Gebruikers ↓	Nieuwe gebruikers	Sessies	Bouncepercentage	Pagina's/sessie	Gem. sessieduur
	2.941 % van totaal: 100,00% (2.941)	2.953 % van totaal: 100,10% (2.950)	4.629 % van totaal: 100,00% (4.629)	2,20% Gem. voor dataweergave: 2,20% (0,00%)	6,19 Gem. voor dataweergave: 6,19 (0,00%)	00:02:31 Gem. voor dataweergave: 00:02:31 (0,00%)
1. United States	564 (18,89%)	559 (18,93%)	580 (12,53%)	4,48%	3,13	00:00:28
2. Greece	465 (15,58%)	469 (15,88%)	718 (15,51%)	0,42%	6,43	00:02:01
3. United Kingdom	227 (7,60%)	225 (7,62%)	435 (9,40%)	0,23%	8,15	00:02:15
4. Italy	176 (5,90%)	175 (5,93%)	372 (8,04%)	0,27%	8,23	00:02:38
5. Belgium	162 (5,43%)	153 (5,18%)	826 (17,84%)	6,05%	8,44	00:07:03
6. Spain	106 (3,55%)	104 (3,52%)	132 (2,85%)	0,76%	5,89	00:01:36
7. France	97 (3,25%)	93 (3,15%)	126 (2,72%)	0,79%	6,98	00:01:52
8. Germany	89 (2,98%)	88 (2,98%)	103 (2,23%)	0,97%	4,89	00:00:59
9. India	87 (2,91%)	86 (2,91%)	102 (2,20%)	5,88%	4,31	00:01:08
10. China	83 (2,78%)	82 (2,78%)	100 (2,16%)	8,00%	4,20	00:01:03

- **Acquisition: how did users end up on the Track and Know project website?**
  - Direct visits
  - Via organic search
  - Via social media

o Via referral (other website, article, etc)
o Other
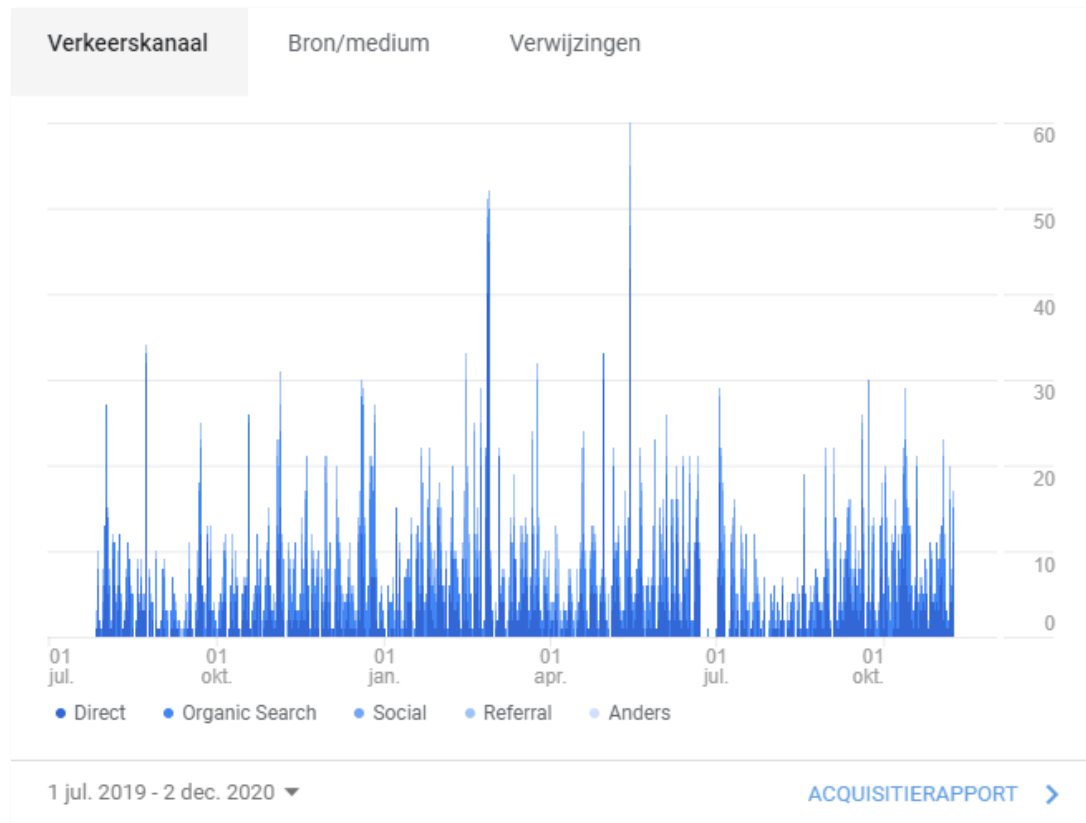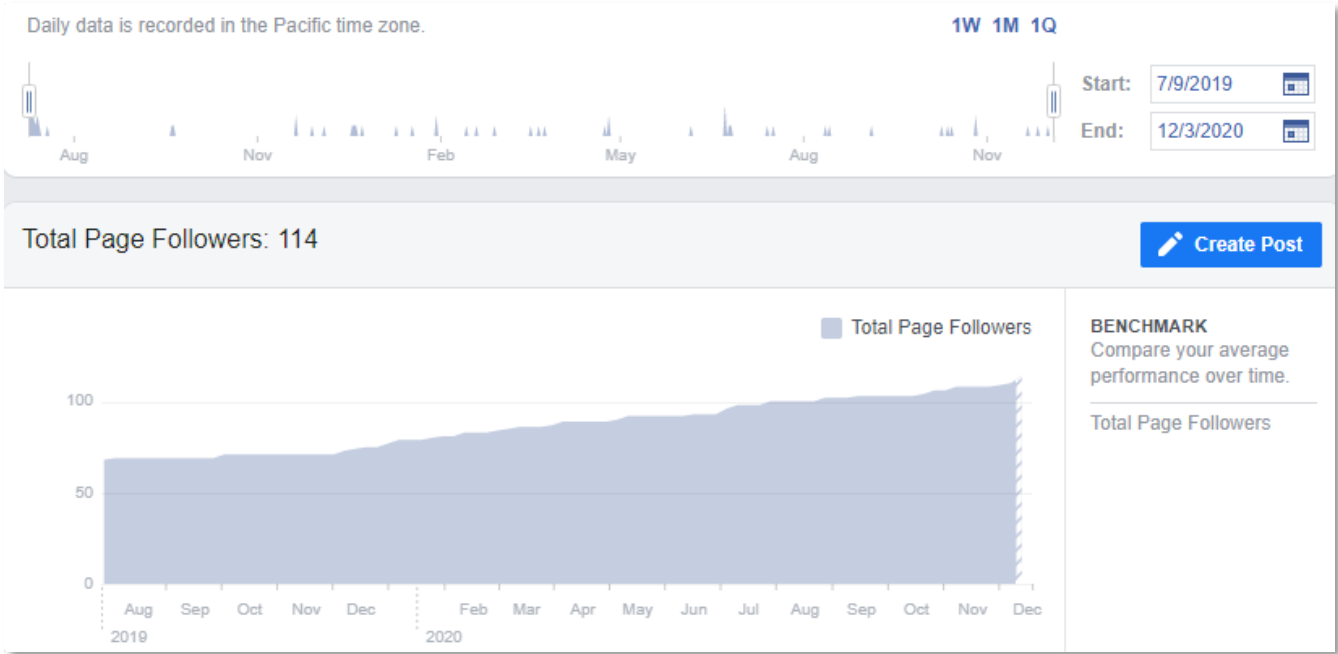

- **Which device did users use to visit the project website?**
  o Almost 85% of users used a desktop
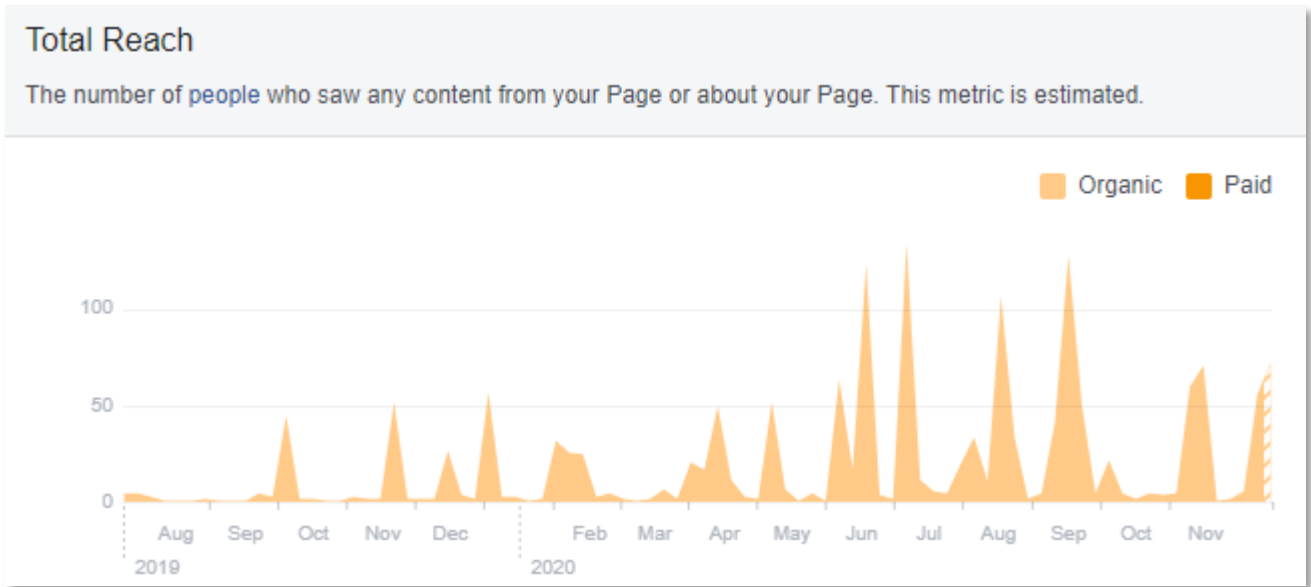 o 14.5% mobile visits
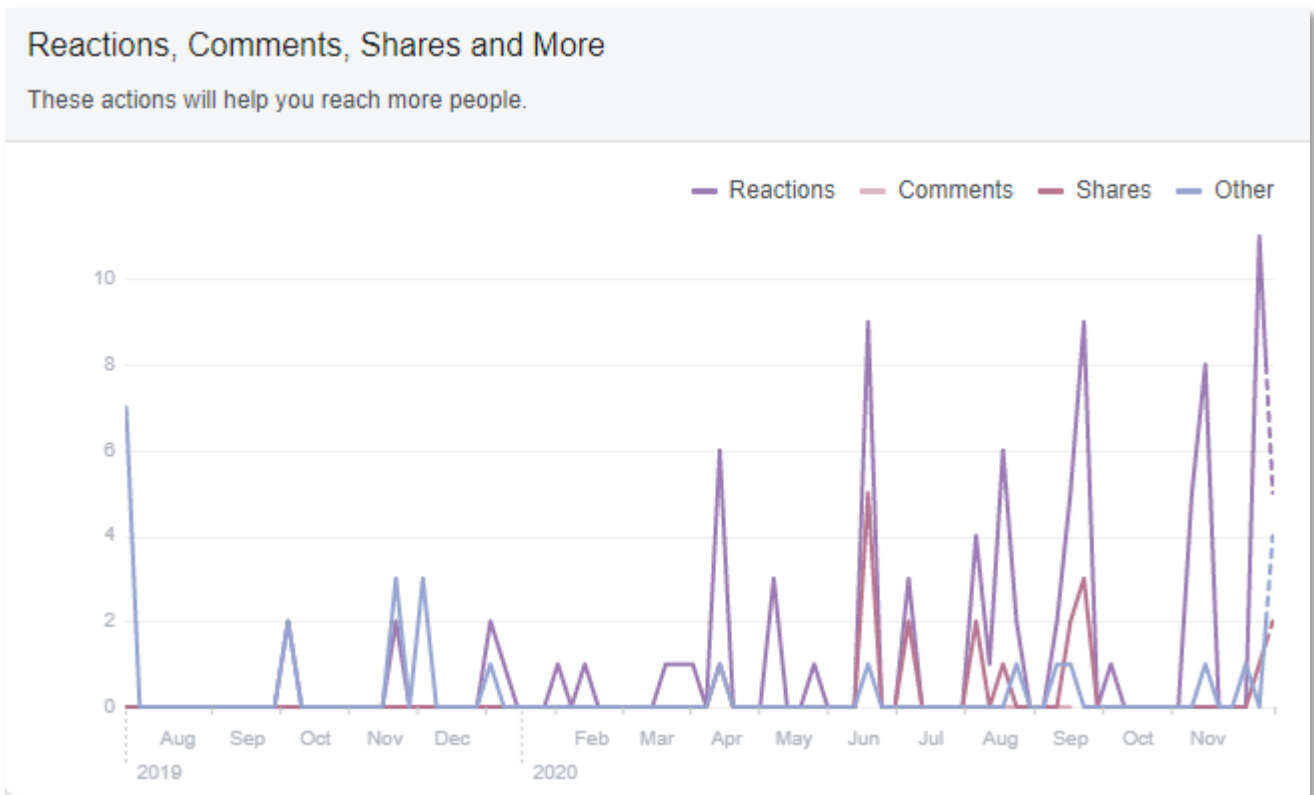 o Only 0.6% via tablet
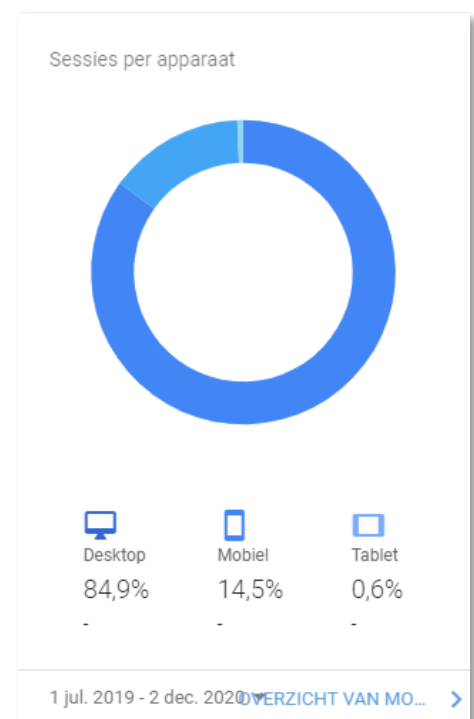
Annex 10: Facebook Insights

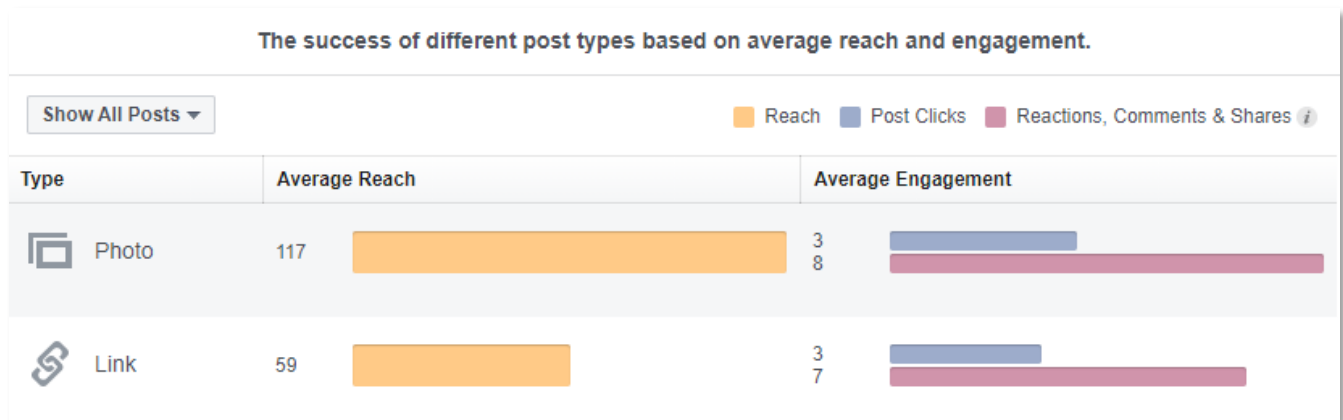- **Audience: 114 followers**

- **Total organic reach**

- **Post reach and post engagement (reactions, comments, shares, other)**

- **Which type of post is most successful?** Posts that include a photo perform better than links

	The success of different post types based on average reach and engagement.		
Show All Posts ▾			Reach ☐ Post Clicks ☐ Reactions, Comments & Shares ⓘ
Type	**Average Reach**		**Average Engagement**
▢ Photo	117	▓▓▓▓▓▓▓▓▓	3 / 8 ▬▬▬▬ / ▬▬▬▬▬▬▬▬▬▬
🔗 Link	59	▓▓▓▓▓	3 / 7 ▬▬▬▬ / ▬▬▬▬▬▬▬▬▬▬

- **Most successful posts (chronologically)**

					Reach: Organic / Paid ▾	Post Clicks	Reactions, Comments & Shares ⓘ ▾
09/04/2019 1:59 PM		Today and tomorrow the exciting intermediate results of the Track &	🔗	🌐	316	22 / 21	▬ / ▬
11/05/2019 11:53 AM		Prof. Yannis Theodoridis and Dr Ibad Kureshi represented the Track &	▢	🌐	493	67 / 44	▬▬▬▬ / ▬▬
10/21/2019 3:00 PM		Catch up on all there is to know about this Horizon 2020 project in the	🔗	🌐	182	8 / 9	▌/ ▌
12/17/2019 1:53 PM		Track & Know research paper "Car telematics big data analytics for	▢	🌐	363	34 / 18	▬▬ / ▬
11/29/2019 10:10 AM		At the recent Bi-Annual British Sleep Society conference in Birmingham	▢	🌐	404	60 / 10	▬▬▬ / ▬
11/26/2019 12:36 PM		6th F2F TackandKnow consortium meeting is currently being held (26-	▢	🌐	193	51 / 12	▬▬▬ / ▬
11/19/2019 11:56 AM		Obstructive Sleep Apnea (OSA) is a common sleep disorder 😴 People	🔗	🌐	234	19 / 26	▬ / ▬

Date		Content			Views		Reactions	
02/17/2020 2:05 PM		Catch up on all there is to know about this Horizon 2020 project in the			372		16 15	
02/12/2020 5:03 PM		New Track & Know conference paper available NOW! Prof. Yannis			219		37 64	
01/28/2020 2:28 PM		Register now to participate in this first international summer school on			252		36 33	
01/21/2020 4:15 PM		Discover what Track & Know is all about! Big Data is everywhere			440		14 14	
01/16/2020 2:03 PM		Track & Know research paper titled "Estimation of travel time			237		20 17	
01/14/2020 9:57 AM		Find out what we have achieved in 2019: https://bit.ly/2Nob6OU. In this			175		9 9	
04/22/2020 1:07 PM		Are you interested in the software used in our proposed research			408		51 21	
05/20/2020 8:04 PM		BigDataStack, I-BiDaaS, Track & Know and Policy Cloud join forces in			998		15 24	
06/24/2020 7:23 PM		The consortium of the @TrackandKnow project just finished			253		41 27	
06/23/2020 4:39 PM		#BigDataPilotDemoDays #series June 25th @ 14:00 CEST!			529		10 21	
06/22/2020 5:02 PM		Track & Know is all about Big Data. But what does that mean? Let's find			224		16 26	
07/06/2020 10:42 AM		Tomorrow at 14.00 CEST Athanasios Koumparos will present our fleet			355		20 23	
07/13/2020 10:20 AM		Join the next free Track & Know webinar in the #bigdata Pilot Demo			461		23 18	
08/05/2020 3:13 PM		Discover the Track & Know Big Data Integration Platform in this 7-minute			301		7 14	
08/04/2020 3:39 PM		Afraid you're going to get lost in our online observatory? Don't worry,			296		4 12	
09/01/2020 10:00 AM		#tb to the Big Data Pilot Demo Days series! This series of interesting			367		5 12	

11/02/2020 10:30 AM		Join I-BiDaaS, BigDataStackEU & Track & Know tomorrow, Tue Nov 3,			337		3 15
11/01/2020 10:00 AM		Join Track & Know at the European Big Data Value Forum 2020 that will			152		4 10
10/30/2020 10:10 AM		Big Data projects i-BiDaaS, BigDataStack and Track & Know			328		8 15
10/29/2020 9:00 AM		Join Track & Know at the European Big Data Forum 2020 that will take			434		18 15

Annex 11: Twitter analytics

- **Followers: a loyal audience of 171 followers**

- **Monthly reports from May, 2018 until December, 2020 included**
  - A total of **100.927 tweet impressions** over a period of 31 months
  - **104 tweets** in total with an average of **970 impressions per tweet**

Year	Month	Tweets	Tweet impressions	Mentions	Profile visits	New followers
2020	Dec	5	3229	3	39	1
2020	Nov	13	5665	18	63	7
2020	Oct	6	2497	8	50	10
2020	Sep	4	2670	1	16	2
2020	Aug	8	4005	1	34	4
2020	Jul	15	8300	12	76	9
2020	Jun	7	5990	6	26	4
2020	May	4	2812	15	44	7
2020	Apr	2	3451	1	12	5
2020	Mar	5	6978	2	93	5
2020	Feb	6	7254	4	109	9
2020	Jan	5	4988	8	47	4
2019	Dec	1	3510	1	36	4
2019	Nov	4	4390	9	93	0
2019	Oct	1	2343	0	20	8
2019	Sep	5	3471	6	17	3
2019	Aug	0	1452	4	8	3

Year	Month					
2019	Jul	1	2774	7	57	5
2019	Jun	12	8158	30	89	8
2019	May		8761			33
2019	Apr		7331			13
2019	Mar		149			3
2019	Feb		190			3
2019	Jan		59			0
2018	Dec		306			1
2018	Nov		30			0
2018	Oct		42			0
2018	Sep		16			1
2018	Aug		27			1
2018	Jul		79			0
2018	Jun					
2018	May					14
TOTAL		**104**	**100927**	**136**	**929**	**153**

- **Example of a monthly report**

Annex 12: Linkedin statistics

Please note that these data date from December 1st, 2020 and will be updated at the end of the project.

- **group members: 189 members in total**

Annex 13: Overview journal papers

Publication Title	Publication theme	Journal
Distributed Subtrajectory Join on Massive Datasets	Big data Integration/Processing	[ACM Transactions on Spatial Algorithms and Systems](#)
Car telematics big data analytics for insurance and innovative mobility services	Big data Analytics	Journal of Ambient Intelligence and Humanized Computing
Estimation of travel time distributions for urban roads using GPS trajectories of vehicles: a case of Athens, Greece	Big data Analytics	Personal and Ubiquitous Computing
Applications of Trajectory Data From the Perspective of a Road Transportation Agency: Literature Review and Maryland Case Study	Visual Analytics	IEEE Transactions on Intelligent Transportation Systems
Guidance in the human-machine analytics process	Visual Analytics	Visual Informatics
COPE: Interactive Exploration of Co-occurrence Patterns in Spatial Time Series	Visual Analytics	IEEE Transactions on Visualization and Computer Graphics
Steering Data Quality with Visual Analytics: the Complexity Challenge	Visual Analytics	Visual Informatics
Pruning techniques for parallel processing of reverse top-k queries	Big Data integration/Processing	[Distributed and Parallel Databases](#)
Online Event Recognition from Moving Vehicle: Application Paper	Big data analytics	Theory and Practice of Logic Programming (SI)
Citywide traffic analysis based on the combination of visual and analytic approaches.	Visual Analytics	Journal of Geovisualization and Spatial Analysis
Spatio-temporal visual analytics: a vision for 2020s	Big data Analytics	Journal of Spatial Information Science

Adaptive simplification of GPS trajectories with geographic context.	Big data Analytics	International Journal of Geographical Information Sciences
Scalable enrichment of mobility data with weather information.	Big data Integration/Processing	GeoInformatica
Ranking places in attributed temporal urban mobility networks	Big data Analytics	PLoS ONE
Does chronic opioid use impact OSA diagnosis and response to treatment with CPAP?	Health care pilot	European Respiratory Journal
Aggregated patient journeys and no-show rates of oximetry outreach network in East Anglia	Health care pilot	BMJ Open Respiratory Research
Flexible trajectory segmentation.	Visual Analytics	GeoInformatica
Geographically transferrable mobility data generation.	Visual Analytics	ACM TIST special issue
Automating and utilizing equal-distribution data classification	Big data Analytics	International Journal of Cartography
Big Data for Mobility Tracking and Knowledge Extraction in Urban Areas (Track & Know)	Overview article	EDMA The Project Repository Journal - January 2021

Annex 14: Overview proceeding papers/presentations

Publication Title	Publication theme	Conference
Integration of Mobility Data with Weather Information	Big Data integration/Processing	EDBT/ICDT workshops 2019
Parallel and Distributed Processing of Reverse Top-k Queries	Big Data integration/Processing	35th IEEE International Conference on Data Engineering
NoDA: Unified NoSQL Data Access Operators for Mobility Data	Big Data integration/Processing	SSTD '19: Proceedings of the 16th International Symposium on Spatial and Temporal Databases
Hot Spot Analysis over Big Trajectory Data	Big data analytics	2018 IEEE International Conference on Big Data
Online learning of weighted relational rules for complex event recognition	Big data analytics	Joint European Conference on Machine Learning and Knowledge Discovery in Databases
Investigating Neighborhood Generation Methods for Explanations of Obscure Image-Classifiers	Big data analytics	Pacific-Asia Conference on Knowledge Discovery and Data Mining
Online Event Recognition from Moving Vehicle: Application Paper	Big data analytics	35th International Conference on Logic Programming
Learning from Our Movements – The Mobility Data Analytics Era	Big data analytics	International Workshop on Multiple-Aspect Analysis of Semantic Trajectories
Learning Mobility Flows from Urban Features with Spatial Interaction Models and Neural Networks	Big data analytics	IEEE International Conference on Smart Computing (SMARTCOMP 2020)

Self-Adapting Trajectory Segmentation	Big data analytics	EDBT/ICDT Workshop on Big Mobility Data Analytics (BMDA 2020)
Data-Driven Location Annotation for Fleet Mobility Modeling.	Big data analytics	EDBT/ICDT Workshop on Big Mobility Data Analytics (BMDA 2020)
Towards In-Memory Sub-Trajectory Similarity Search	Big data analytics	EDBT/ICDT Workshop on Big Mobility Data Analytics (BMDA 2020)
Analysis of Flight Variability: a Systematic Approach	Visual Analytics	IEEE Transactions on Visualization and Computer Graphics
Time-aware sub-trajectory clustering in hermes@postgresql	Visual Analytics	IEEE 34th International Conference on Data Engineering (ICDE)
Contextualized Analysis of Movement Events	Visual Analytics	EuroVis Workshop on Visual Analytics (EuroVA)
Cross-scale spatial enrichment of trajectories for speeding up similarity computing	Visual Analytics	International conference on Location based services (LBS 2019)
Crash Prediction and Risk Assessment with Individual Mobility Networks	Big data analytics	21st IEEE International Conference on Mobile Data Management (MDM 2020)
Vehicle mobility data analysis and Individual Mobility Networks for crash prediction	Big data analytics	5th Italian conference on ICT for Smart Cities and Communities (I-CiTIes 2019)
Scalable distributed sub trajectorty Clustering	Big data analytics	IEEE International Conference on Big Data (Big Data)
Scalable Indexing and Querying of Spatio-temporal Data in NoSQL Stores	Big Data integration/Processing	EDBT'21

Big Mobility Data Analytics: Algorithms and Techniques for Efficient Trajectory Clustering	Big data analytics	IEEE MDM 2020
Obstructive sleep apnoea (OSA) severity in patients with chronic opioid use: a risk factor matched study.	Health care pilot	British Thoracic Society 2019
Obstructive Sleep Apnoea (OSA) and response to CPAP treatment in patients with chronic opioid use.	Health care pilot	British Thoracic Society 2018
Social deprivation appears to be a barrier to referral for investigation of obstructive sleep apnoea.	Health care pilot	BTS Winter meeting Feb 2021
A Demonstration of NoDA: Unified Access to NoSQL Stores	Big Data integration/Processing	EDBT'21
NoDA paper	Big Data integration/Processing	VLDB 2021
FLP paper	Big Data integration/Processing	ECMLPKDD 2021
Time Series Prediction from Multiple Factors		ESANN2020
Time series prediction & generation from disentangled latent factors: new opportunities for smart cities		ITSC2020
Aggregated patient journeys and no-show rates of oximetry outreach network in east anglia	Health care pilot	British Sleep Society 2019
Does chronic opioid use impact OSA diagnosis and response to treatment with CPAP?	Health care pilot	European Resp Society 2020

Annex 15: KPI reports

Please note that these data date from December 1st, 2020 and will be updated at the end of the project.

Dissemination goal	Target quantity	M35 status
Publications (Scientific & Industrial target group)	Open access will be granted to all scientific publications resulting from Track&Know, targeting at Big-Data Analytics, Interactive Visual Analytics, Machine Learning, Data and Information management groups.	**full PDF online observatory is online since the end of January 2019**
Papers at scientific conferences appearing in proceedings	At least 30 publications (ICT and ITS, Transportation Research Arena, Transport, Transportation Research Board Annual Meeting, Business & Marketing Conferences).	**32 conference papers, including submitted papers**
Papers in Journals	At least 12 publications in high impact journal (ICT and ITS, Transportation Research Arena, Transport, Transportation Research Board Annual Meeting, Business & Marketing Conferences).	**19 journal papers, including accepted/submitted papers**
Press releases	At least 2: One for the technological developments and their impact in each use case scenarios.	**5 press releases up to now, in different languages, 1 upcoming release (end of the project)**
Web Site visits	800 p.a. with 1/3 spending more than 2 minutes on the site	**3K unique users 4.6K sessions Average duration per session: 2m30s See Annex 10 for details**
Social Media Presence	Established groups in at least 2 networks (e.g. LinkedIn, Twitter) with regular updates. Evidence of engagement with target audience – demonstrated via comments, sharing of relevant content, RTs etc.	**An overall total of 500 followers Extensive reach on Twitter & Facebook See Annexes 11-12-13 for details**
Stakeholders interest groups and meetings with stakeholders	At least 6 (2 per use case: One for validating the use case requirements and one for validating the project outcomes)	**7 stakeholder workshops/webinars up to now - 10 other liaison events (including the 3 Big Data Pilot Demo Days webinars)**
Demonstrations of prototypes at industry-dominated events	At least 2 (one big-data event, one smart mobility related event)	**upcoming**

Bi-lateral collaboration with other projects working in the field established	Measured by existing exchange of knowledge and/or models or implementations. Track&Know targets at achieving high throughput and visibility within collaboration and exploitation synergies.	**Various collaborations with 9 liaison projects: Transforming Transport, e-SIDES & DataBio, DataBench, BigMedilytics, BodyPass, Extreme Earth, Musketeer, SmartDataLake, I-BiDaas and BigDataStack**
Project brochure with project results		**will be released end December 2020**
Popular articles	At least 5 in popular magazines	**13 publications + 2 upcoming publications (including articles, podcasts, TV report)**
Final event		**4 sessions during the EBDVF 2020 conference in November 2020**
Tutorial sessions	At least 1 per toolbox	**3**
Tutorial videos	1 per toolbox	**3**
Course material for university colleges		**course material consists of an online package per toolbox including a tutorial session recording + relevant research papers and background info**