Deliverable D.7.031

Demo Report for Data Collection I

WP 7 – Piloting the SLOPE demonstrator

Task 7.3 – Trials and validation cycle

Revision: Final

Authors: Umberto Di Staso, Daniele Magliocchetti

Author name (Partner name): GraphiTech

Dissemination level	PU (Public)
Contributor(s)	Jakub Sandak (CNR), Juan de Dios Diaz (ITENE), Liam Murphy (COASTWAY), Martin Kühmaier (BOKU)
Reviewer(s)	Daniele Magliocchetti (GraphiTech), Umberto Di Staso (GraphiTech)
Editor(s)	Daniele Magliocchetti (GraphiTech),
Partner in charge(s)	GraphiTech
Due date	31-Mar-16
Submission Date	31-Aug-16

Co-founded by the European Commission

REVISION HISTORY AND STATEMENT OF ORIGINALITY

Revision History

Revision	Date	Author	Organisation	Description
0.1	08.06.2016	Umberto Di Staso	GraphiTech	Table of Contents Metadata Provided
0.2	14.06.2016	Liam Murphy	COASTWAY	Metadata Provided
0.3	15.06.2016	Martin Kühmaier	BOKU	Metadata Provided
0.4	16.06.2016	Juan de Dios Diaz	ITENE	Metadata Provided
0.5	17.06.2016	Umberto Di Staso	GraphiTech	Integration
0.6	18.06.2016	Jakub Sandak	CNR	Metadata Provided
0.7	20.06.2016	Umberto Di Staso	GraphiTech	First Version
0.8	22.08.2016	Jakub Sandak	CNR	Post-Pilot Metadata provided
0.9	23.08.2016	Umberto Di Staso	GraphiTech	Second Version
1.0	24.08.2016	Daniele Magliocchetti	GraphiTech	Final Revision

Statement of originality

This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

Table of contents

List of figures

Acronyms

DBH	Diameter at breast height
NS	Norway Spruce
PUP	Piano Urbanistico Provinciale (Urban plan of the Province)
DSM	Digital Surface Model
DTM	Digital Terrain Model
RFID	Radio- Frequency IDentification
ASCII	American Standard Code for Information Interchange
CCCI	Canopy Chlorophyll Content Index
CHL	Canopy Chlorophyll
NDRE	Normalized Difference Red Edge
NDVI	Normalized Difference Vegetation Index
TLS	Terrestrial Laser Scanner
UAV	Unmanned aerial vehicle
SW	Shock Wave
QI	Quality Index
CP	Cutting Power
HI	Hyperspectral Imaging
LVDT	Linear Variable Differential Transformer

1 Introduction

Metadata are data that are used to describe other data. The main purpose of metadata is to facilitate the discovery of relevant information, more often classified as resource discovery. Metadata also help organize electronic resources, provide digital identification and help archiving and preservation of the resources. Metadata assists in resource discovery allowing them to be found by relevant criteria, bringing similar resources together, distinguishing dissimilar resources, and giving location information. Best practices are demonstrating how metadata cataloguing improve the productivity by:

1. **Speed Up** the re-use of collected information in other context/pilots;
2. **Keep Track** of the *semantic* of data;
3. **Improve** the replicability of pilots, showing and describing what data are required, which formats, etc.

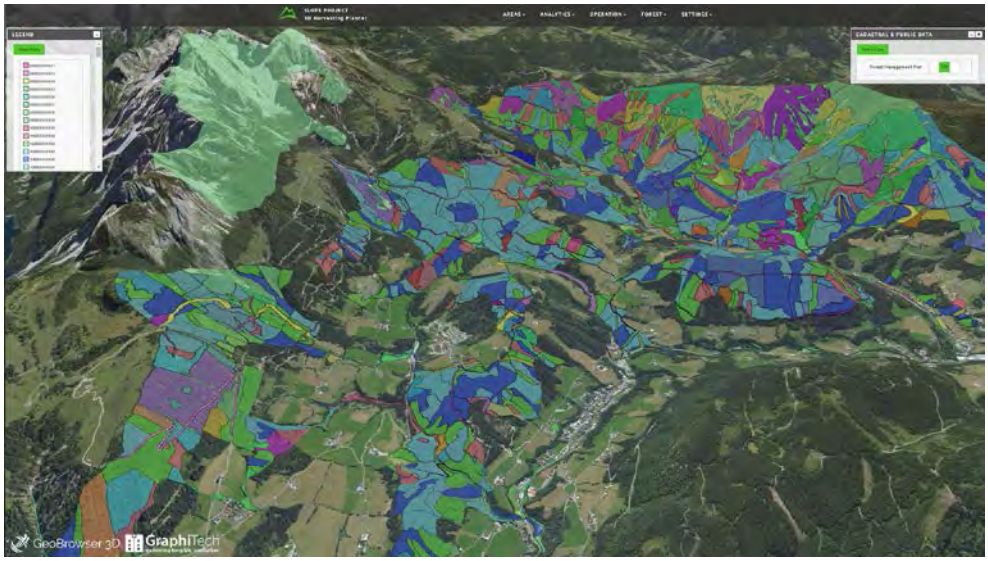

Figure 1: Forest Management Plan

1.1 Structure of the document

The Deliverable *D.7.031 – Demo Report for Data Collection I* is composed by four chapters. After a preliminary introduction (Chapter 1) related to metadata and metadata inventory definitions, scope of the deliverable and used approach, Chapter 2 contains the result table generated by the metadata survey filled by each involved partner. It is important to underline that these metadata refer to information available before the first pilot demonstration in Sover, conducted at the beginning of July 2016. The following chapter, Chapter 3, contains quantitative

statistics about the collected metadata, in particular the number of datasets surveyed by pilots and by typology.

In order to overcome the gap between the available data before and after the first pilot implementation, Chapter 4 contains the set of information collected during the first pilot tests. Finally, Chapter 5 contains a prevision of metadata to be collected during the second pilot test in Annaberg that will be integrated into the next revision of the deliverable: *D.7.03.2 Demo Report for Data Collection II*.

1.2 Scope

In order to achieve its objectives, the SLOPE project requires a huge amount of data, coming from sources of different nature: some of them can be provided by third parties organizations (such as data distributed as Open Data), others are generated in real-time or processed from sensors installed on specific intelligent machines.

To facilitate the integration phase, reach higher qualitative standards and improve the replicability process, building a data inventory is fundamental. The scope of this report is to provide a clear and harmonized description of the information collected until the first pilot located in Sover, Trento (Italy), from the beginning of the project.

1.3 Approach

In order to simplify and speed up the process of metadata acquisition by data providers, a survey template, attached as Annex I, was designed and distributed across the involved partners. The survey template was composed by six attributes, specifically:

1. **Data Source**: provides a list of all possible mechanism (hardware components or other data sources) used to retrieve and provide information.
    a. Acoustic Measurements: the vibration signal received by the laser displacement sensor after mechanical excitation of the log by hammer;
    b. Cable Crane: data acquired by the cable crane and its components, e.g. TECNO;
    c. Cutting Power: measured tree cutting force;
    d. Forest Inventory: general information related to the trees that will be processed;
    e. Harvesting Planning: general information related to the forest area that will be processed;
    f. Hyperspectral Imaging: hyperspectral maps of the stand;

g. Intelligent Truck: data coming by the intelligent truck system, e.g. GPS position and speed;
h. Near Infrared Spectroscopy: images acquired by NIR cameras;
i. Open Data: data released as *Open*, mainly acquired by each individual municipality Open Data Portal;
j. Processor Head: data coming from sensors installed on the processor head;
k. RFID Tags: RFID tags applied to each log;
l. Supply Chain: wood supply information;
m. UAV Data: other data coming from UAVs;
n. Terrestrial Laser Scanner (TLS): point cloud 3D reconstruction acquired by TLS technology;
o. Other: other information that does not belong to the previous categories.

2. **Referring on**: provides the list the pilot locations. The "Other" option is available to enable the collection of metadata information retrieved from other test opportunities (e.g. laboratory tests, extra test on the field, etc.).
    a. Sover: pilot demonstration in Sover, Italy, performed in July 2016;
    b. Piscine: pilot in Piscine, Italy;
    c. Annaberg: pilot demonstration in Annaberg, AT, planned for October 2016;
    d. Other: e.g. data acquired during laboratory testing.
3. **Typology**: used to specify the type of the data.
4. **Format**: used to specify the format of the data.
5. **Description**: brief description of the dataset, if not self-explanatory.
6. **Quantitative Parameters**: used to report quantitative parameters, e.g. the KM^2 of area covered by an UAV survey.

2 Metadata Inventory

The following table contains the complete set of metadata acquired during the data inventory phase. These metadata are referring to the time-range starting from the beginning of the project and the end of June 2016.

Table 1 - Metadata Inventory

Provider	Data Source	Referring to	Typology	Format	Brief description of the dataset	Quantitative parameters
BOKU	Forest inventory	Annaberg	DBH	cm	Diameter of the tree in breast height (1.3 m)	0.42 ha
BOKU	Forest inventory	Annaberg	Tree height	m	Height of the tree form the ground to the top of the crown	0.42 ha
BOKU	Forest inventory	Annaberg	Slope	%	Average slope along the cable corridor	0.42 ha
BOKU	Forest inventory	Annaberg	Stand density	n/ha	Number of trees per area	0.42 ha
BOKU	Forest inventory	Annaberg	Tree species	-	Tree species (e.g. Norway Spruce, Larch, Beech)	0.42 ha
BOKU	Harvesting planning	Annaberg	Extraction distance	m	Distance of the trees to be moved along the cable corridor to the landing (processing site)	0.42 ha
BOKU	Harvesting planning	Annaberg	Lateral yarding distance	m	Distance of the trees to be moved from the felling site to the cable corridor	0.42 ha
BOKU	Harvesting planning	Annaberg	Harvesting intensity	%	Number of trees to be harvested in relation to total number of trees	0.42 ha

BOKU	Harvesting planning	Annaberg	DSM	ASCII	Digital Surface Model generated from Airborne Laser Scanning in a 1 m resolution	200 ha
BOKU	Harvesting planning	Annaberg	DTM	ASCII	Digital Terrain Model generated from Airborne Laser Scanning in a 1 m resolution	200 ha
BOKU	Harvesting planning	Annaberg	Vector Data	Shapefile	Forest Management Plan	43.8054 km^2
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Copse	723.08 km^2
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Provincial Forests - PUP	104.034 km^2
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Forest Roads	7763.23 km
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	High Forest	2728.47 km^2
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	High Voltage Lines	1257.6 km
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Pipeline	7488.261 km
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Roads - PUP	3454.67 km
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Unproductive Land	381.45 km^2
GraphiTech	Open Data	Piscine	Vector Data	Shapefile	Wooded Cliffs - PUP	239.609 km^2
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Copse	723.08 km^2
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Provincial Forests - PUP	104.034 km^2
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Forest Roads	7763.23 km
GraphiTech	Open Data	Sover	Vector Data	Shapefile	High Forest	2728.47 km^2
GraphiTech	Open Data	Sover	Vector Data	Shapefile	High Voltage Lines	1257.6 km
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Pipeline	7488.261 km
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Roads - PUP	3454.67 km
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Unproductive Land	381.45 km^2
GraphiTech	Open Data	Sover	Vector Data	Shapefile	Wooded Cliffs - PUP	239.609 km^2
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Wetland	2550.49 km^2
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Footpath	14871.9 km

GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Rivers	6300.95 km
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Lift Systems	483.581 km
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Natural Reserve	368.888 km^2
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Ski Slopes	50.1222 km^2
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Street and Road Network	36642.5 km
GraphiTech	Open Data	Annaberg	Vector Data	Shapefile	Forests	3585.18 km^2
COASTWAY	UAV Data	Piscine	DSM	TIFF	Digital Surface Model	0.75 km
COASTWAY	UAV Data	Piscine	DSM	LAS	Digital Surface Model	0.75 km
COASTWAY	UAV Data	Piscine	OrthoPhotography	TIFF	OrthoPhotography	0.75 km
COASTWAY	UAV Data	Piscine	OrthoImagery	TIFF	Multispectral Imagery	0.75 km
COASTWAY	UAV Data	Sover	DSM	TIFF	Digital Surface Model	0.5 km
COASTWAY	UAV Data	Sover	DSM	LAS	Digital Surface Model	0.5 km
COASTWAY	UAV Data	Sover	OrthoPhotography	TIFF	OrthoPhotography	0.5 km
COASTWAY	UAV Data	Sover	OrthoImagery	TIFF	Multispectral Imagery	0.5 km
COASTWAY	UAV Data	Annaberg	DSM	TIFF	Digital Surface Model	0.8 km
COASTWAY	UAV Data	Annaberg	DSM	LAS	Digital Surface Model	0.8 km
COASTWAY	UAV Data	Annaberg	OrthoPhotography	TIFF	OrthoPhotography	0.8 km
COASTWAY	UAV Data	Annaberg	OrthoImagery	TIFF	Multispectral Imagery	0.8 km
ITENE	Intelligent Truck	Sover	String	Text	GPS data Altitude - 20 seconds resolution	1200 observations
ITENE	Intelligent Truck	Sover	String	Text	GPS data Latitude - 20 seconds resolution	1200 observations
ITENE	Intelligent Truck	Sover	String	Text	GPS data Longitude - 20 seconds resolution	1200 observations
ITENE	RFID Tags	Sover	String	Text	ID of the logs being introduced in the truck, acquired at the starting time and ending time	60 tags

FLYBY	Hyperspectral Imaging	Sover	OrthoImagery	ASCII	CCCI Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Sover	OrthoImagery	ASCII	CHL Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Sover	OrthoImagery	ASCII	NDRE Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Sover	OrthoImagery	ASCII	NDVI Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Piscine	OrthoImagery	ASCII	CCCI Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Piscine	OrthoImagery	ASCII	CHL Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Piscine	OrthoImagery	ASCII	NDRE Satellite images	500 km^2
FLYBY	Hyperspectral Imaging	Piscine	OrthoImagery	ASCII	NDVI Satellite images	500 km^2

TREEMETRICS	Other	Piscine	Vector Data	Shapefile	Production area	38904 m^2
TREEMETRICS	Other	Piscine	Vector Data	Shapefile	TLS detected trees	141 points
TREEMETRICS	Other	Piscine	Vector Data	Shapefile	UAV detected trees	1302 polygons
TREEMETRICS	Terrestrial Laser Scanner	Annaberg	Point Cloud	FLS	TLS RAW data	141 sample plots

3 Metadata Statistics

The aim of this chapter is to analyse the distribution of collected metadata over the three pilots and data source.

In the following table it is possible to observe how, at the current stage of the project, there is a well-balanced distribution of input information over the three involved pilots: the total number of datasets collected is composed by 65 different information.

Table 2 - Total amount of data collected for each Pilot

PILOTS	
Annaberg	24
Sover	21
Piscine	20
TOTAL	65

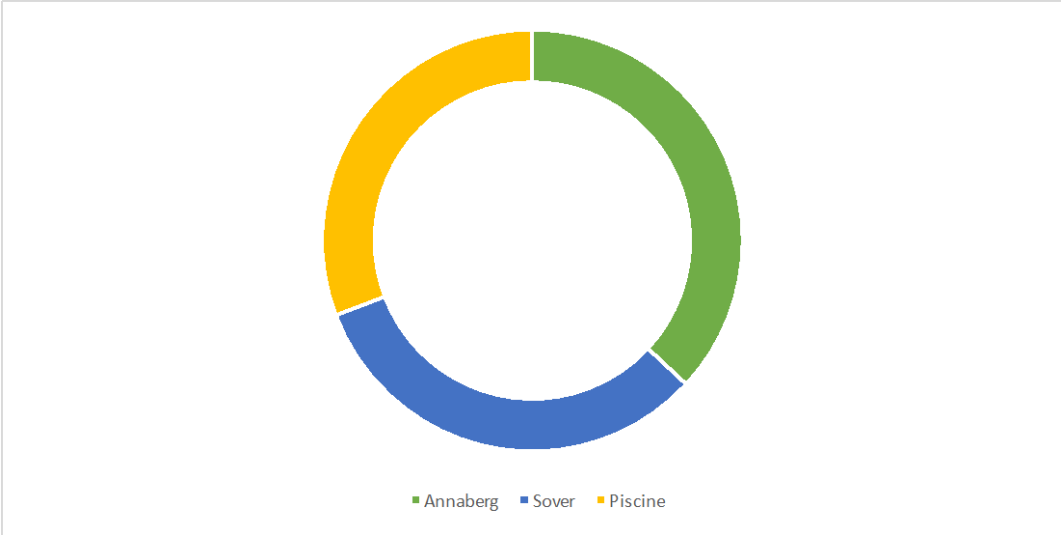

Figure 2: Data distribution by Pilots

Similar as before, data reported in the previous chapter can be grouped by Data Source, as the following table shows. It is important to underline that the set of currently inventoried data does not include information collected during Pilots demonstrations, for this reason there is no evidence of entries coming from sensors.

Table 3 - Total amount of data collected for each category

CATEGORIES	
Acoustic Measurements	0
Cable Crane	0
Cutting Power	0
Forest Inventory	5
Harvesting Planning	5
Hyperspectral Imaging	8
Intelligent Truck	3
Near Infrared Spectroscopy	0
Open Data	27
Processor Head	0
RFID Tags	1
Supply Chain	0
UAV Data	12
Terrestrial Laser Scanner	1
Other	3
TOTAL	65

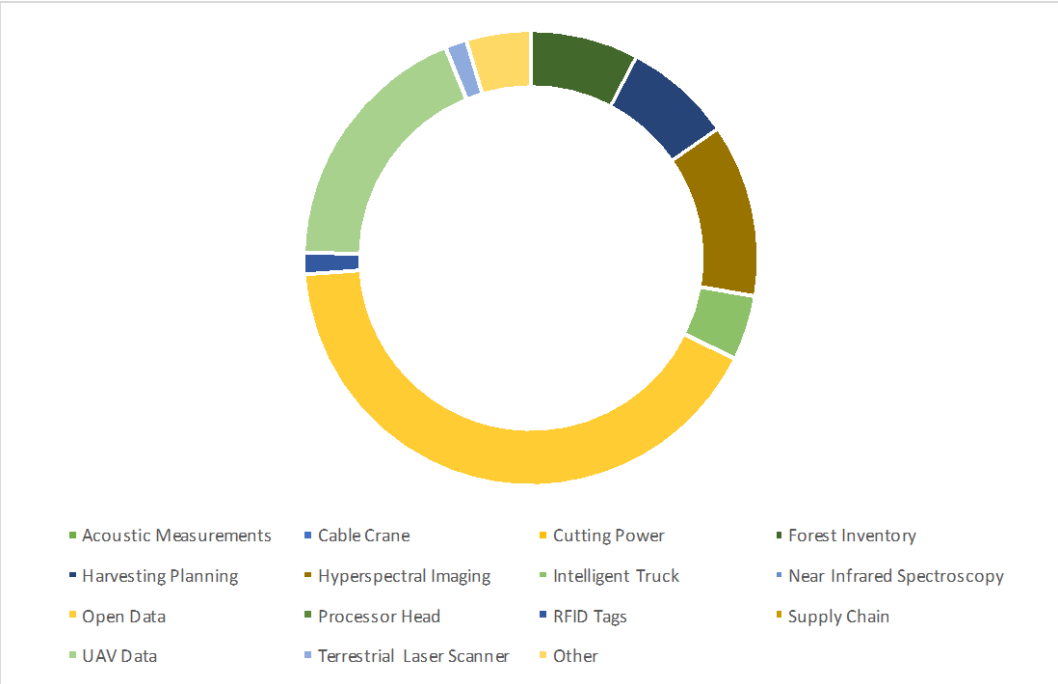

Figure 3: Data distribution by Categories

4 Metadata Collection During the First Pilot Demonstration

The following table contains the set of metadata collected during the first pilot demonstration in Sover, Trento (Italy) at the beginning of July 2016. The information typology allows to fill the gap with missing data information coming from sensors measurements reported in Table 3.

Table 4 – Metadata to information collected in Sover during the first Pilot demonstration

Data Source	Referring on	Typology	Format	Brief description of the dataset	Quantitative Parameters
Acoustic measurement	Sover	SW 1st sensor response	Waveform	The vibration signal received by the accelerometer #1 after trespassing of the stress wave along the log length	Time of flight between hammer and accelerometer #1: (ms)
Acoustic measurement	Sover	SW 2nd sensor response	Waveform	the vibration signal received by the accelerometer #2 after trespassing of the stress wave along the log length	Time of flight between hammer and accelerometer #2: (ms) + time of flight between accelerometer #1 and accelerometer #2: (ms)
Acoustic measurement	Sover	Stress wave velocity	Number: double	The average velocity of the stress wave throughout wood	Velocity: (m/s)
Acoustic measurement	Sover	SW#2 free vibrations excitation trigger	Waveform	The signal generated by the accelerometer at the moment of the impact of the hammer on the log cross	Time of the start of the excitation signal: (ms)

				section, generated for each measurement	
Acoustic measurement	Sover	SW#2 laser displacement distance response	Waveform	The vibration signal received by the laser displacement sensor after mechanical excitation of the log by hammer	Displacement: (mm)
Acoustic measurement	Sover	SW#2 free vibrations frequency	Number: double	FFT transform based fundamental frequency of the log	Frequency: (Hz)
Cutting power	Sover	Cutting force measured on the knife left	Number: double	Reading of the load cell #1	Force: (N) converted from electrical tension: (V)
Cutting power	Sover	Cutting force measured on the knife right	Number: double	Reading of the load cell #2	Force: (N) converted from electrical tension: (V)
Cutting power	Sover	Cutting force measured on the central piston	Number: double	Reading from the pressure sensor #1	Force: (N) converted from electrical tension: (V)
Cutting power	Sover	Map of the knot distribution in log	2D array: double	Positions and estimated sizes of knots detected by means of cutting forces in one log	Relative size: (-) and location: (-) of knots in log
Cutting power	Sover	CP#1 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Cutting power	Sover	CP#1 QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)

Cutting power	Sover	CP#1 QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Cutting power	Sover	Cutting resistance of the chain saw	Number: double	Reading from the pressure sensor #2	Force: (N) converted from electrical tension: (V)
Cutting power	Sover	Cutting speed velocity of the chain saw	Number: double	Reading from the flow sensor	Velocity: (m/s) converted from electrical tension: (V)
Cutting power	Sover	Feed force of the chain saw bar	Number: double	Reading from the pressure sensor #3	Force: (N) converted from electrical tension: (V)
Cutting power	Sover	Chain saw bar position	Number: double	Reading from the LVDT	Rotation angle: (°) converted from electrical tension: (V)
Cutting power	Sover	Log diameter at the cross cutting	Number: double	Reading from encoder #1	Diameter: (m) converted from counts
Cutting power	Sover	Momentary cutting resistance	Number: double	Cutting force in cross-cutting in a function of the log diameter position	Nominal cutting resistance: (-)
Cutting power	Sover	Specific cutting resistance of cross-cutting	Number: double	Cutting energy needed to cross-cut log of certain diameter	Specific cutting resistance: (-)
Cutting power	Sover	CP#2 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Hyperspectral imaging	Sover	VIS-NIR spectra at sensor "n"	1D array: double	Reading from Hamamatsu spectrometer	Absorbance spectra: (-)
Near infrared spectroscopy	Sover	NIR spectra at sensor "n"	1D array: double	Reading from microNIR spectrometer	Absorbance spectra: (-)

Near infrared spectroscopy	Sover	NIR moisture index at sensor "n"	Number: double	Number quantifying moisture content of wood estimated by VIS-NIR (0 - dry, 1 - wet)	Moisture index: (0-1)
Near infrared spectroscopy	Sover	NIR knot index at sensor "n"	Number: double	Number quantifying similarity to knot estimated by VIS-NIR (0 - normal wood, 1 - knot)	Knot index: (0-1)
Near infrared spectroscopy	Sover	NIR compression wood at sensor "n"	Number: double	Number quantifying similarity to compression wood estimated by VIS-NIR (0 - normal wood, 1 - compression wood)	Compression wood index: (0-1)
Near infrared spectroscopy	Sover	NIR decay index at sensor "n"	Number: double	Number quantifying similarity to decayed wood estimated by VIS-NIR (0 - normal wood, 1 - decayed wood)	Decay index: (0-1)
Near infrared spectroscopy	Sover	NIR resin index at sensor "n"	Number: double	Number quantifying similarity to resin estimated by VIS-NIR (0 - normal wood, 1 - resin)	Resin index: (0-1)
Near infrared spectroscopy	Sover	NIR bark index at sensor "n"	Number: double	Number quantifying similarity to bark estimated by VIS-NIR (0 - normal wood, 1 - bark)	Bark index: (0-1)
Near infrared spectroscopy	Sover	NIR profile of moisture	1D array: double	Profile of moisture distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Sover	NIR profile of knots	1D array: double	Profile of knots distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Sover	NIR profile of compression wood	1D array: double	Profile of compression wood distribution on the cross section of log	Property distribution profile

Near infrared spectroscopy	Sover	NIR profile of decay	1D array: double	Profile of knots decay distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Sover	NIR profile of resin	1D array: double	Profile of resin distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Sover	NIR profile of bark	1D array: double	Profile of bark distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Sover	NIR QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)

5 Metadata Collection Planned the Second Pilot Demonstration

The following table contains the set of metadata planned to be collected during the second pilot demonstration in Annaberg, Austria in October 2016. The complete set of surveyed metadata will be than available in deliverable *D.7.03.2 Demo Report for Data Collection II*.

Table 5 – Metadata to information planned to be collected in Annaberg during the second Pilot demonstration

Data Source	Referring on	Typology	Format	Brief description of the dataset	Quantitative parameters
Acoustic measurement	Annaberg	SW excitation trigger	Waveform	The signal generated by the accelerometer at the moment of the impact of the hammer on the log, generated for each measurement	Time of the start of stress wave propagation: (ms)
Acoustic measurement	Annaberg	SW 1st sensor response	Waveform	The vibration signal received by the accelerometer #1 after trespassing of the stress wave along the log length	Time of flight between hammer and accelerometer #1: (ms)
Acoustic measurement	Annaberg	SW 2nd sensor response	Waveform	The vibration signal received by the accelerometer #2 after trespassing of the stress wave along the log length	Time of flight between hammer and accelerometer #2: (ms) + time of flight between accelerometer #1 and accelerometer #2: (ms)
Acoustic measurement	Annaberg	Stress wave velocity	Number: double	The average velocity of the stress wave in wood	Velocity: (m/s)

Acoustic measurement	Annaberg	Stress velocity map (log)	1D array: double	Series of SW measurements for each processed log	Velocity: (m/s)
Acoustic measurement	Annaberg	Stress wave velocity map (tree)	2D array: double	Series of SW measurements for each processed tree	Velocity: (m/s)
Acoustic measurement	Annaberg	Stress wave velocity map (forest)	3D array: double	Series of SW measurements for the whole forest	Velocity: (m/s)
Acoustic measurement	Annaberg	SW#1 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Acoustic measurement	Annaberg	SW#1 QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)
Acoustic measurement	Annaberg	SW#1 QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Acoustic measurement	Annaberg	SW#2 free vibrations excitation trigger	Waveform	The signal generated by the accelerometer at the moment of the impact of the hammer on the log cross section, generated for each measurement	Time of the start of the excitation signal: (ms)
Acoustic measurement	Annaberg	SW#2 laser displacement distance response	Waveform	The vibration signal received by the laser displacement sensor after mechanical excitation of the log by hammer	Displacement: (mm)
Acoustic measurement	Annaberg	SW#2 free vibrations frequency	Number: double	FFT transform based fundamental frequency of the log	Frequency: (Hz)

Acoustic measurement	Annaberg	SW#2 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Acoustic measurement	Annaberg	SW#2 QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)
Acoustic measurement	Annaberg	SW#2 QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Cutting power	Annaberg	Cutting force measured on the knife left	Number: double	Reading of the load cell #1	Force: (N) converted from electrical tension: (V)
Cutting power	Annaberg	Cutting force measured on the knife right	Number: double	Reading of the load cell #2	Force: (N) converted from electrical tension: (V)
Cutting power	Annaberg	Cutting force measured on the central piston	Number: double	Reading from the pressure sensor #1	Force: (N) converted from electrical tension: (V)
Cutting power	Annaberg	Map of the knot distribution in log	2D array: double	Positions and estimated sizes of knots detected by means of cutting forces in one log	Relative size: (-) and location: (-) of knots in log
Cutting power	Annaberg	Map of the knot distribution in tree	3D array: double	Positions and estimated sizes of knots detected by means of cutting forces in one tree	Relative size: (-) and location: (-) of knots in tree

Cutting power	Annaberg	Map of the knot distribution in forest	4D array: double	Positions and estimated sizes of knots detected by means of cutting forces in one forest	Relative size: (-) and location: (-) of knots in all trees in one forest
Cutting power	Annaberg	CP#1 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Cutting power	Annaberg	CP#1 QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)
Cutting power	Annaberg	CP#1 QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Cutting power	Annaberg	Cutting resistance of the chain saw	Number: double	Reading from the pressure sensor #2	Force: (N) converted from electrical tension: (V)
Cutting power	Annaberg	Cutting speed velocity of the chain saw	Number: double	Reading from the flow sensor	Velocity: (m/s) converted from electrical tension: (V)
Cutting power	Annaberg	Feed force of the chain saw bar	Number: double	Reading from the pressure sensor #3	Force: (N) converted from electrical tension: (V)
Cutting power	Annaberg	Chain saw bar position	Number: double	Reading from the LVDT	Rotation angle: (°) converted from electrical tension: (V)

Cutting power	Annaberg	Log diameter at the cross cutting	Number: double	Reading from encoder #1	Diameter: (m) converted from counts
Cutting power	Annaberg	Momentary cutting resistance	Number: double	Cutting force in cross-cutting in a function of the log diameter position	Nominal cutting resistance: (-)
Cutting power	Annaberg	Specific cutting resistance of cross-cutting	Number: double	Cutting energy needed to cross-cut log of certain diameter	Specific cutting resistance: (-)
Cutting power	Annaberg	CP#2 QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Cutting power	Annaberg	CP#2 QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)
Cutting power	Annaberg	CP#2 QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Hyperspectral imaging	Annaberg	VIS-NIR spectra at sensor "n"	1D array: double	Reading from Hamamatsu spectrometer	Absorbance spectra: (-)
Hyperspectral imaging	Annaberg	VIS-NIR moisture index at sensor "n"	Number: double	Number quantifying moisture content of wood estimated by VIS-NIR (0 - dry, 1 - wet)	Moisture index: (0-1)
Hyperspectral imaging	Annaberg	VIS-NIR knot index at sensor "n"	Number: double	Number quantifying similarity to knot estimated by VIS-NIR (0 - normal wood, 1 - knot)	Knot index: (0-1)

Hyperspectral imaging	Annaberg	VIS-NIR compression wood at sensor "n"	Number: double	Number quantifying similarity to compression wood estimated by VIS-NIR (0 - normal wood, 1 - compression wood)	Compression wood index: (0-1)
Hyperspectral imaging	Annaberg	VIS-NIR decay index at sensor "n"	Number: double	Number quantifying similarity to decayed wood estimated by VIS-NIR (0 - normal wood, 1 - decayed wood)	Decay index: (0-1)
Hyperspectral imaging	Annaberg	VIS-NIR resin index at sensor "n"	Number: double	Number quantifying similarity to resin estimated by VIS-NIR (0 - normal wood, 1 - resin)	Resin index: (0-1)
Hyperspectral imaging	Annaberg	VIS-NIR bark index at sensor "n"	Number: double	Number quantifying similarity to bark estimated by VIS-NIR (0 - normal wood, 1 - bark)	Bark index: (0-1)
Hyperspectral imaging	Annaberg	Hyperspectral map of moisture	2D array (image): integer	Image of moisture distribution on the cross section of log	Image
Hyperspectral imaging	Annaberg	Hyperspectral map of knots	2D array (image): integer	Image of knots distribution on the cross section of log	Image
Hyperspectral imaging	Annaberg	Hyperspectral map of compression wood	2D array (image): integer	Image of compression wood distribution on the cross section of log	Image
Hyperspectral imaging	Annaberg	Hyperspectral map of decay	2D array (image): integer	Image of knots decay distribution on the cross section of log	Image

Hyperspectral imaging	Annaberg	Hyperspectral map of resin	2D array (image): integer	Image of resin distribution on the cross section of log	Image
Hyperspectral imaging	Annaberg	Hyperspectral map of bark	2D array (image): integer	Image of bark distribution on the cross section of log	Image
Hyperspectral imaging	Annaberg	HI QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Hyperspectral imaging	Annaberg	HI QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)
Hyperspectral imaging	Annaberg	HI QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)
Near infrared spectroscopy	Annaberg	NIR spectra at sensor "n"	1D array: double	Reading from Hamamatsu spectrometer	Absorbance spectra: (-)
Near infrared spectroscopy	Annaberg	NIR moisture index at sensor "n"	Number: double	Number quantifying moisture content of wood estimated by VIS-NIR (0 - dry, 1 - wet)	Moisture index: (0-1)
Near infrared spectroscopy	Annaberg	NIR knot index at sensor "n"	Number: double	Number quantifying similarity to knot estimated by VIS-NIR (0 - normal wood, 1 - knot)	Knot index: (0-1)
Near infrared spectroscopy	Annaberg	NIR compression wood at sensor "n"	Number: double	Number quantifying similarity to compression wood estimated by VIS-NIR (0 - normal wood, 1 - compression wood)	Compression wood index: (0-1)

Near infrared spectroscopy	Annaberg	NIR decay index at sensor "n"	Number: double	Number quantifying similarity to decayed wood estimated by VIS-NIR (0 - normal wood, 1 - decayed wood)	Decay index: (0-1)
Near infrared spectroscopy	Annaberg	NIR resin index at sensor "n"	Number: double	Number quantifying similarity to resin estimated by VIS-NIR (0 - normal wood, 1 - resin)	Resin index: (0-1)
Near infrared spectroscopy	Annaberg	NIR bark index at sensor "n"	Number: double	Number quantifying similarity to bark estimated by VIS-NIR (0 - normal wood, 1 - bark)	Bark index: (0-1)
Near infrared spectroscopy	Annaberg	NIR profile of moisture	1D array: double	Profile of moisture distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR profile of knots	1D array: double	Profile of knots distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR profile of compression wood	1D array: double	Profile of compression wood distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR profile of decay	1D array: double	Profile of knots decay distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR profile of resin	1D array: double	Profile of resin distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR profile of bark	1D array: double	Profile of bark distribution on the cross section of log	Property distribution profile
Near infrared spectroscopy	Annaberg	NIR QI (log)	Number: double	Number quantifying the overall quality of log and suitability for selected applications	Quality class: (-)
Near infrared spectroscopy	Annaberg	NIR QI (tree)	1D array: double	Number quantifying the overall quality of logs within one tree	Quality class: (-)

Near infrared spectroscopy	Annaberg	NIR QI (forest)	2D array: double	Number quantifying the overall quality of trees within one forest	Quality class: (-)

6 Conclusions

This deliverable provides a complete and exhaustive metadata survey related to information collected until the end of the first pilot demonstration in Monte Sover, July 2016.

Preparatory activities were clearly visible in the amount of data retrieved before July 2016, where acquired metadata was mainly related to UAV surveys and other data used for planning activities, while live data coming from machineries was collected during the first demonstration phase.

In total, during the aforementioned phase, it was possible to collect the 65% of the planned data. The missing 35% of on-field data has been unavailable due the prototype nature of the intelligent machines and their unexpected behaviours.

Chapter 5 reports a candidate list of information that will be collected in October 2016, during the second pilot demonstration in Annaberg, Austria. This preliminary list, which should complete the missing data, will be used for inventory purpose during the planned activities and will be confirmed and updated in D7.0.32 at month 36.

7 ANNEX I – Survey Template

This annex contains the survey template sent to the partners involved in this deliverable, to collect metadata related to the information collected before the first pilot trials in Sover, Italy.

Table 6 Metadata Survey Template

Data Source *Select option from the list*	**Referring on** *Select option*	**Typology** *(e.g. DSM, DTM, oil pressure)*	**Format**	**Brief description of the dataset**	**Quantitative parameters** *(e.g. size, km², nr. points)*
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				
Acoustic Measurements	Annaberg				