An efficient and effective platform for the cooperation of photonics clusters and the exploitation of European SMEs potential.

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Project Acronym: **LightJumps**

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WP2 - Photonic Community Building and needs assessment
Deliverable D2.2.1
"Classification Scheme"

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Dissemination Level		
PU	Public	**x**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

1 Contents

1 Glossary

EC	European Commission
REST	Representational state transfer
EPIC	European Photonic Industry Consortium
OPERA 2015	Optics and Photonics in the European Research Area
SPIE	International Society for Optics and Photonics
SME	Small and Medium Enterprises
DOW	Description of Work
DB	Data base

2 Introduction

This document describes the classification scheme to be used by the LightJumps Knowledge Management and partnering platform.

The design concept of the classification scheme was based on two main pillars:

- Make use of previous studies and available information on the Photonics sector by designing a scheme from the integration of data coming from different existing data sets, with specific attention to the EPIC and the PHOTONIC 21 database of the European Photonics organisations.
- Keep the classification scheme simple to be a user-friendly information tool for the LightJumps community, mostly relevant to categorize Photonics organizations, but also used for other relevant documents.

For this purpose, the scheme was designed to collect and integrate in a single database the information coming from different data sets. New methodologies to retrieve relevant information were then implemented to allow users for an easy introduction of the data, while avoiding database population over a pre-defined scheme. Then the resulting classification scheme was made accessible to any user through direct access from the LightJumps website and REsTful services (details in Chapter 4).

The deliverable has been submitted with two months of delay with respect to the initial planning due to the following reasons:

- The retroactive Grant Agreement date and the project starting date in December that did not favoured a quick start;
- The design of the classification scheme required several meetings with the owners of the databases used as sources for the input data, and this was difficult to be organised in a short time frame.

The two months of delay did not impact any other activity in the project. Overall, the activities performed have been:

- Analysis of the previous studies;
- Analysis of on-going initiatives and existing databases;
- Meetings and discussions with the database owners;
- Design of the classification scheme.

3 Classification scheme design

In order to design the classification scheme, a deep analysis of the literature and results of previously realised EC funded projects was conducted. The main focus was to select the data sources and the specific parameters (tags) for the Photonics sector to be able to provide a web tool that was easy to access with a wide range of information. For this purpose a number of documents were taken into account such as:

- Description of Work, which was already identifying a set of classification parameter useful to achieve the LightJumps purposes;
- OPERA 2015 documentation, namely the Deliverable 2.2;
- Information on SPIE taxonomy used to map the Photonic 21 database of SMEs;
- EPIC (www.epic-assoc.com) and Photonic 21 (www.photonic21.org) databases;
- The application domains defined in the project ACTPHAST (www.actphast.eu; FP7-ICT-2013-11–619205);
- Jeppix web site (www.jeppix.eu) information structure and registration form;
- Other available documentation related to Photonics technologies and markets.

In addition to that, further analysis was conducted on:

- Available taxonomies, thesaurus and relevant categorisation on the Photonics sector;
- Structure of available databases of organisations / projects / technologies in the Photonics sector.

Finally, CTECH discussed on possible cooperation with organisations managing database of organisations / projects / technologies in the Photonics sector, in particular EPIC and PHOTONIC 21.

On the basis of the activities described above, it emerged that the design concept of the LightJumps classification scheme was an interoperable database merging the information available in EPIC (about 5000 organisations) and also PHOTONIC 21 (about 2000 organisations). As a result, the collected data would have been available on the LightJumps web site, but also on any other web site that wanted to query the web Services that LightJumps would have made available.

Both EPIC and PHOTONIC 21 agreed on the proposed approach, therefore the main requirement for the design of the classification scheme was to be compliant with both the database structures of such organisations.

In addition to that, a set of parameters to classify organisations was identified from the available taxonomies analysis. In particular to provide relevant information for the knowledge repository structure of LightJumps on the Photonics sector the following parameters were introduced:

- **Products/research areas** in order to classify the organizations on the basis of their own technologies, the main Photonics areas are selected in line with the results of OPERA 2015.

- The **application domain**, as the main areas where Photonic technologies are used. This information is considered to be quite helpful when LightJumps will have to deal with the individual business cases of the organizations, to classify them not strictly related to their technology but also to their market potential; to define such application domains, the application domains used in the ACTPHAST public available classification have been taken into consideration; this can also enforce collaboration among the two projects in the future. Moreover, CTECH verified that such application domains were compatible with the other classification areas / tags defined using other sources, such as SPIE classification.
- The **innovation areas**, meant as main direction for innovation of technologies in the Photonic sector; for such areas, the main definition from SPIE were taken into consideration.

It is important to note that CTECH also contacted TNO as responsible of the deliverable 2.1 of the project Opera 2015 (Optics and Photonics in the European Research Area). Such deliverable was a database in Access with a set of defined tags (a sort of taxonomy) that was used to map the database of organisation of PHOTONIC 21 to extract information.

Almost all the tags used are now part of the database structure of the PHOTONIC 21 database, and therefore they have been considered in the LightJumps classification scheme design. Other classification fields and related tags described in such Deliverable were not considered because it was not a public document.

In the following sub sections the information gathered and analysed in this work is reported.

3.1 Info from Lightjumps DoW

Companies Schema:

Info required by the source	Data Type
Size	Text field.
Cluster	Text field.
Geographical Location	Text field.
Sector	Text field.(options proposed: Lighting, sensors, lasers, aerospace)
Links to other local or EU RTD Entities	Text field.

Rtd Centres Schema:

Info required by the source	Data Type
Geographical Location	Text field.
Scientific and Technological Sectors/Research Interests	Text field.(options proposed: Lighting, sensors, lasers, aerospace)
Links to national and regional clusters	

3.2 Photonics 21

Company Form / Research Institute/University Form:

Info required by the source		Data Typology	Already considered	In Classification Schema corrispond to:
Company name / Name of the research institute/ The university		Text field.	✓	Organisation Name
Address	Name (as part of the address)	Text field.	✓	Address
	Street			Address
	Street Number			Address
	Postal Code			Address
	City			Address
	Country			Geographical Location
Website		Link to the company/research institute website	✓	Website
Product Groups / Research Area		Text field. Possibility to choose one or more of the options*	✓	Product Groups / Research Area

***Product Groups / Research Area**

1. Adaptive optics
2. Active Optical Devices
3. Biophotonics
4. Cameras
5. Coatings
6. Coherent optics
7. Colorimetry
8. Detectors
9. Diffractive optics
10. Displays
11. Fiber Optics
12. Glass & Other Optical Materials
13. Holography
14. III-V and II-VI materials
15. Industrial processing
16. Information Storage
17. Lasers
18. Lasers applications
19. Light Sources
20. Light-matter interaction
21. Liquid crystals

22. Micro Optics
23. Nano Photonics
24. Nanophotonics
25. Nonlinear optics
26. Optical communications and networks
27. Optical Components
28. Optical Components and Devices
29. Optical computing
30. Optical data storage and processing
31. Optical Design
32. Optical diagnostic and control
33. Optical diodes
34. Optical engineering
35. Optical fibre devices and research
36. Optical imaging
37. Optical instrumentation
38. Optical interconnects
39. Optical Manufacturing Equipment
40. Optical measurement systems and sensors
41. Optical microscopy
42. Optical parametric processes and devices
43. Optical scientific computation and modeling
44. Optical sensors
45. Optical solitons
46. Optical sources in infrared, visible, UV, X optical spectrum
47. Optoelectronics
48. Other materials for optics and photonics
49. Packaging of optical components
50. Passive optical components
51. Photodynamic processes and research
52. Photo-induced processes
53. Photoionisation
54. Photoluminescence and fluorescence
55. Photonic crystals
56. Photonic hybrid architectures
57. Photonic integration
58. Photonic lightwave circuits
59. Photorefractive effects, devices and research
60. Photovoltaics
61. Plasma research and applications
62. Plasmonics
63. Polarization related optical devices and research
64. Polymers and organic materials
65. Quantum optics, devices and research
66. Rare earth-based devices and research
67. Semiconductors materials, processes, devices
68. Short-pulses generation and characterization
69. Signal and image processing
70. Sol-gel optics and technologies
71. Sources of X-radiation by plasmas
72. Spectacles

73. Spectroscopy
74. Terahertz spectroscopy
75. Test & Measurement Systems
76. Theoretical optics and photonics
77. Thin films and thin layers
78. Ultrafast optics

3.3 SPIE - Photonics 21

Taxonomy of Photonic Innovations:

First level	Second level
Effect Based (approach to security) operations	Directed Energy Weapons
Efficient and Effective healthcare and cure	Consumer eletronics for healthcare
	Targeted drug treatment
	Transplantation of Tissue and Organs
	Utilities for Earcly Diagnostics
	Advanced therapies and therapeutic tools
High-Tech Product manufacturing	Rapid Prototyping/Rapid manufacturing
	Laser material processing
	Optical manufacturing equipment
	Semi-conductor component manufacturing
	Smart testing and analysis facilities
Homeland security system	(Satelite) Surveillance Systems
	Forensic methods
	Automatic Identification Systems
Novel energy systems and concepts	Photovoltaic solar energy
	Nuclear fusion
	Solar thermal energy
Scientific Instruments laboratory	Particle physics instruments
	Scientific instruments
Smart consumer products	Advanced digital cameras
	(Personalised) Opthalmic systems
	Smart clothing
	Fast and reliable networks
	Optical computer products
	Next generation displays
Sustainable agricolture efficient	Precision farming

	Greenhouse agricolture
Sustainable living environment	Monitoring systems for building and construction
	Environmental monitoring systems
Sustainable transport and logistics	Night vision systems
	Navigation systems
Utilization of space and deep Sea	Astronomy and planetary probes
	Earth observations systems

Taxonomy of Photonic Technologies:

First level	Second level
Advanced Materials Technology	Optical Materials
	Lighting and display technologies
	Photovoltaic
	Functional Coatings
Advanced Computer Technology	Quantum Computing
	Information Storage Concepts
	Optical computing technologies
	Optical Chip technology
	Optical network technology
Molecular Biotechnologies	DNA Analyses
	Genetic imaging/Sequencing
	Biophotonics Technologies
Intelligent Electronics and Mechatronics	Micro electromechanical systems (MEMS)
New Technologies for analysing, modifying and creating materials	Lasers technologies
	Optical Labelling Technologies
	Advanced Sensors technology
	Detector Technologies
	Light materials interactions
	Advanced Imaging and radiotherapy technology
	Lens Technology
Next Generation Software Technologies	Advanced Simulations
	Development of optical design software

3.4 EPIC- Database of photonics companies in Europe

Info required by the source	Data
Organization	Represent the typology of Organization–the options are: 1. Association 2. Cluster 3. Company 4. Consulting 5. Magazine/Media 6. Research 7. University 8. University /Research
Name	It is the name of the organization
Address	Text field.
City	Text field.
Zip code	Text field.
Country	Text field.
Website	Link to the organization website
Product/Technologies	Free text field
Research Areas	Text field. Possibility to choose one or more of the options *

***Research Areas**

1. 4D microscopy
2. Active Optical Devices
3. Adaptive optics
4. Atoms
5. automation
6. Biophotonics
7. Cameras
8. CMOS image sensors
9. Coatings
10. Coherent optics
11. Colorimetry
12. Design and small-batch fabrication of dielectric optical coatings for diverse photonics applications
13. Detectors
14. Development and implementation of laser technologies
15. Development of compact room temperature operating THz imaging arrays for security and diagnostics systems
16. development of novel optoelectronic devices and optoelectronic systems
17. Development of specialized solid-state and fiber lasers
18. Diffractive optics
19. Displays
20. Femtosecond and other laser processes
21. Fiber Optics
22. Glass & Other Optical Materials
23. Growth of dilute bismide layers for infrared light emitters and photodetectors

24. high-speed and high dynamic range imaging
25. Holography
26. III-V and II-VI materials
27. Industrial processing
28. Information Storage
29. Label-free optical bio-sensing, time-resolved fluorescence detection
30. Laser microstructuring of materials, Nonlinear optical materials
31. Lasers
32. Lasers applications
33. Light Sources
34. Light-matter interaction
35. Liquid crystals
36. Micro Optics
37. Micro Photonics
38. Modeling of light propagation in waveguides and photonic-crystal structures and the structures themselves
39. Modelling of active materials and photonic structures.
40. Nano Photonics
41. Nanophotonics
42. Nonlinear optics
43. OLED, OPV, Organic Photodiodes, nano- and micro- optics, light management, optical security devices, holograms, printed optoelectronics, bio-sensing
44. Optical communications and networks
45. Optical Components
46. Optical components and devices
47. Optical computing
48. Optical data storage and processing
49. Optical data storage materials
50. Optical design
51. Optical design and modelization
52. Optical diagnostic and control
53. Optical diodes
54. Optical engineering
55. Optical fibre devices and research
56. Optical fibre devices and sensors
57. Optical imaging
58. Optical instrumentation
59. Optical instrumentation ans systems
60. Optical interconnects
61. Optical Manufacturing Equipment
62. Optical measurement systems and sensors
63. Optical microscopy
64. Optical microscopy
65. Optical packaging
66. Optical parametric processes and devices
67. Optical scientific computation and modeling
68. Optical sensors
69. Optical solitons
70. Optical sources in infrared, visible, UV, X optical spectrum
71. optical spectrum
72. Optoelectronics

73. Other
74. Other materials for optics and photonics
75. Packaging of optical components
76. Passive optical components
77. Photodynamic processes and research
78. Photo-induced processes
79. Photoionisation
80. Photoluminescence and fluorescence
81. Photon-counting
82. Photonic crystals
83. Photonic hybrid architectures
84. Photonic integration
85. Photonic lightwave circuits
86. Photorefractive effects, devices and research
87. Photovoltaics
88. Plasma research and applications
89. Plasmonics
90. Polarization related optical devices and research
91. Polymers and organic materials
92. Quantum optics, devices and research
93. Rare earth-based devices and research
94. Research and develop new solid-state laser technologies
95. Semiconductors materials, processes, devices
96. Short-pulses generation and characterization
97. Signal and image processing
98. Sol-gel optics and technologies
99. Sources of X-radiation by plasmas
100. Spectacles
101. Spectroscopy
102. Surface laser processing of ceramics, glass, metals and polymers
103. Terahertz pulse emission of semiconductor surfaces illuminated by femtosecond laser radiation
104. Terahertz spectroscopy
105. Test & Measurement Systems
106. Theoretical optics and photonics
107. Theoretical optics and photonics, Biophotonics
108. Thin films and thin layers
109. Ultrafast optics
110. Visual inspection
111. X-ray detectors

3.5 ACTPHAST

Info required by the source	Data
Sector	Text field. Possibility to choose one or more of the following options: - Photonic - general - Aerospace - Automotive - Building and construction - Communication - Energy - Entertainment - Food - Medical / Life science - Lighting and Display - Plastics - Production technology - Textiles - Others
Application domains	Text field. Possibility to choose one of the options *

*** Application domains**

- *Automotive* (Night vision system, Datacom bus system, Sensor system, other)
- *Biomedicine* (Photonic enabled microfluid, imaging guides, sensor catheters, RI sensors, Opto-fluidics, minimal invasive diagnostic, Treatment monitoring by imaging, Retinal implants, Microinstruments for early diagnostic of cancer, Endomicroscopes for colonoscopy gastroscopy bronchoscopy, Miniature OCT system)
- *Biotechnology* (Opto-fluidics, Bio-chips, Lab-on-chip system, Point-of-care diagnostics, Microcytometers, µTAS devices)
- *Communication* (FTTH connectivity & components, R2R, B2B,... interconnects, Optical interconnect systems, DC fibres, Amplifying fibres, λ-stabilizers)
- *Environmental monitoring* (Strain sensors, Temperature sensors, Vibration sensors, Chemical sensors)
- *Green energy* (Solar energy harvesting, Lighting)
- *Home automation* (IR remote control, Fingerprint sensors, Retinal scanners, Safety labels, Security systems)
- *Information technology* (Micro displays, Cameras, Scanners, Projectors, Printers)
- *Laser machining* (High power fibres, LMA fibres, Doped fibres, Low bend loss fibres)
- *Lighting* (OLED, Light guiding surfaces, Intelligent lighting)
- *Manufacturing* (Machine vision systems, Distance sensors, Optical encoders, Laser beam coupling and beam-shaping, Lithography and digital printing)
- *Multimedia* (LED based projection, Advanced displays, Mobile devices, 3D camera systems, Microdisplays, Scanners, Barcode readers, SLMS, Micro-projectors, Micro-cameras, HMDs, Switches)
- *Optical metrology* (Miniature confocal microscopes, Microinterferometers, Industrial endoscopes, Micro-spectrometers)
- *Sensors and security* (IR optics, Nightvision systems, Thermal cameras)
- *Smart optical system* (Spectrophotometers, Wireless remote optical monitoring sensors)
- *Spectroscopy* (Supercontinuum sources, Large core fibres, UV-VIS-NIR fibres, λ-filters)

3.6 SPIE Taxonomy

First Level	Second Level
Test and Measurement; instrumentation	Astronomical Instruments & Telescopes
	Microscopy
	Spectroscopy devices, tools and equipment
	Test and Measurement, Metrology
Sensors, detectors, cameras	Cameras and Imaging systems
	Detectors and Sensors
Signal Analysis, Data processing, Computing	Computing/Data Processing hardware
	Electronic/Digital Imaging
	Electrical/Signal Analysis Equipment
Displays and Illumination	Displays
	LED, OLED, non-laser light sources
Optoeletronics and electronics	Electronics, components
	Optoelectronics components or devices (non-telecom)
	Optomechanical components,equipment, systems
	Optical communication devices and equipment
Laser, optics, fiberoptics	Fiber Optics and accessories
	Laser components and accessories
	Lasers and systems
	Misc consumables and equipment
	Emerging Photonics Technologies
	Optical Fabrication Equipment
	Optical Components - Lenses
	Silicon photonics, photonics circuits and interconnects
	Optical Components - filters, mirrors,other optics
Manufacturing equipment	Materials processing; manufacturing
	Litographic equipment
Mounts and Positioning	Mounts, Tables, Vibration Isolation
	Positioning equipment and accesorize
Materials	Optical Coatings, Thin Films
	Photonic materials
	Nanotechnology, nanophotonics

3.7 Opera2015

Classification of the Products/Research areas

General optics	Coherent optics
	Colorimetry
	Diffractive optics
	Holography
	Lasers
	Lasers applications
	Light-matter interaction
	Nonlinear optics
	Optical engineering
	Optical scientific computation and modelling
	Optical solitons
	Photodynamic processes and research
	Photo-induced processes
	Photoionisation
	Photoluminescence and fluorescence
	Photorefractive effects, devices and research
	Plasma research and applications
	Plasmonics
	Polarization related optical devices and research
	Quantum optics, devices and research
	Short-pulses generation and characterization
	Theoretical optics and photonics
	Ultrafast optics
Optical technologies	Optical sources in infrared, visible, UV, X optical
	Spectrum
	Optoelectronics
	Packaging of optical components
	Sol-gel optics and technologies
	Sources of X-radiation by plasmas
Instrumentation	Optical instrumentation
	Optical measurement systems and sensors
	Signal and image processing
	Spectroscopy
	Terahertz spectroscopy
Optical devices	Active optical devices
	Adaptive optics

	Optical components and devices
	Optical design
	Optical diagnostic and control
	Optical diodes
	Optical fibre devices and research
	Optical imaging
	Optical interconnects
	Optical microscopy
	Optical parametric processes and devices
	Optical sensors
	Passive optical components
	Photonic crystals
	Photonic hybrid architectures
	Photonic integration
	Photonic lightwave circuits
	Rare earth-based devices and research
	Semiconductors materials, processes, devices
Optical materials	III-V and II-VI materials
	Glasses and ceramics
	Liquid crystals
	Other materials for optics and photonics
	Polymers and organic materials
	Silicon based materials
	Thin films and thin layers
Optical applications	Astronomy
	Biophotonics
	Industrial processing
	Nanophotonics
	Optical communications and networks
	Optical computing
	Optical data storage and processing
	Photovoltaics

4 Overview of data import and mapping

The approach that was proposed to access data from external databases, bring it into the classification scheme connected to the LightJumps website is described in the schematic shown in Figure 1. In the details, the steps are summarized as it follows:

- The intermediary organisations provide (in excel or other exportable formats) the data of their database of organisations towards LightJumps;
- LightJumps makes us of a mapping strategy to import data into the LIGHTJUMPS classification scheme (see next section);
- Web Services will be developed to allow external clients to access and update data towards the LightJumps database;
- Each organisation registered in the database will be able to modify its data, possibly enriching them through forms made available through the client database, and through the LightJumps web site;
- Each intermediary organisation will be able to develop its client interface that query the LightJumps database through Web Services and show the results. Moreover, each intermediary organisation will have the possibility to update the database (through Web Services) by accepting new registration and sending such information to the LightJumps database;
- In the case the intermediary organisation will decide to stop the collaboration, will receive the database of organisation that were initially registered with the intermediary organisation, and all the newly registered organisations;
- The database and Web Services will be developed by CTECH within the LightJumps project, while each intermediary organisation willing to access such data shall develop its web client interface for the query and visualisation of the results. CTECH will support such phase acting as help desk and providing clarification on the web services.

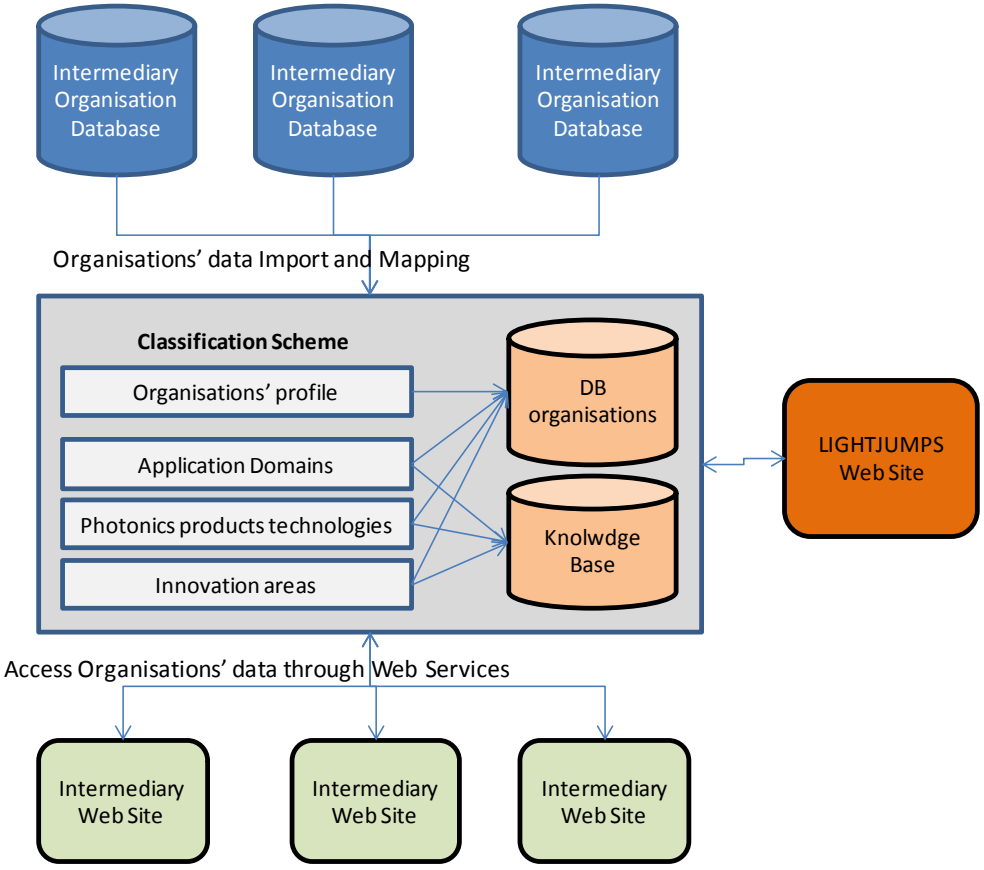

Figure 1 – Overview of LightJumps approach for data import and mapping

In order to finalize the overall approach for data import and mapping, agreements have been established with EPIC and PHOTONIC 21, and will be fostered with other organisations / projects (example: ACTPHAST).

Moreover, a particular analysis was conducted on the Jeppix platform (as indicated in the DOW) for possible data integration in the LightJumps platform. It emerged that the Jeppix platform is targeted to a specific domain and the alignment of their classification scheme with the one used in LightJumps was a serious obstacle, mostly for what it concerned the brokerage functionalities of products. Figure 2 shows the criteria used in Jeppix for some of its specific functionalities of partnering / supplying components. As a consequence, it was decided that the collaboration with Jeppix could have been established in different forms (network, exchange of link, promotion of services, etc.) but no with direct and automatic integration of data from their databases.

	Performance		
Building block	InP	Si	TriPleX
Passive components	●	●●	●●●
Lasers	●●●	o	o
Modulators	●●●	●●	●
Switches	●●●	●●●	●
Optical amplifiers	●●●	o	o
Detectors	●●●	●●●	o
Footprint	●●	●●●	●
Chip cost	●	●●	●●
CMOS compatibility	oo	●●	●
Low cost packaging	o	o[1]/●●[2]	●●

[1] Endfire coupling (low refl.)

[2] Vertical coupling (med. refl.)

Performance	
●●●	Very good
●●	Good
●	Modest
o	Challenging

Figure 2. Example of specific Photonics areas in Jeppix.

5 Classification scheme methodology

The classification scheme of LightJumps is described in Fig. 3 and it groups input data on the basis of:

- **General parameters**, independent on the specific sector/technology:
  - Organisation profiles (name, surname, email, Country, region, address, web site, ...);
  - Documents (author, date of modification, etc.);
  - Patents (Inventor, claim, year, etc.);
  - Scientific papers (Author, year, etc.);
  - Projects (Coordinating organisation, year, duration of project, etc.).

  The selection of these general parameters was made to have a set of criteria to tag the organisations profile, main interest of the LightJumps project, and also a way to map the databases of other photonics organisations into the LIGHT JUMPS scheme.

- **Photonics specific parameters** to tag information specific to the Photonics area such as product/research area, application domain, and also innovation.

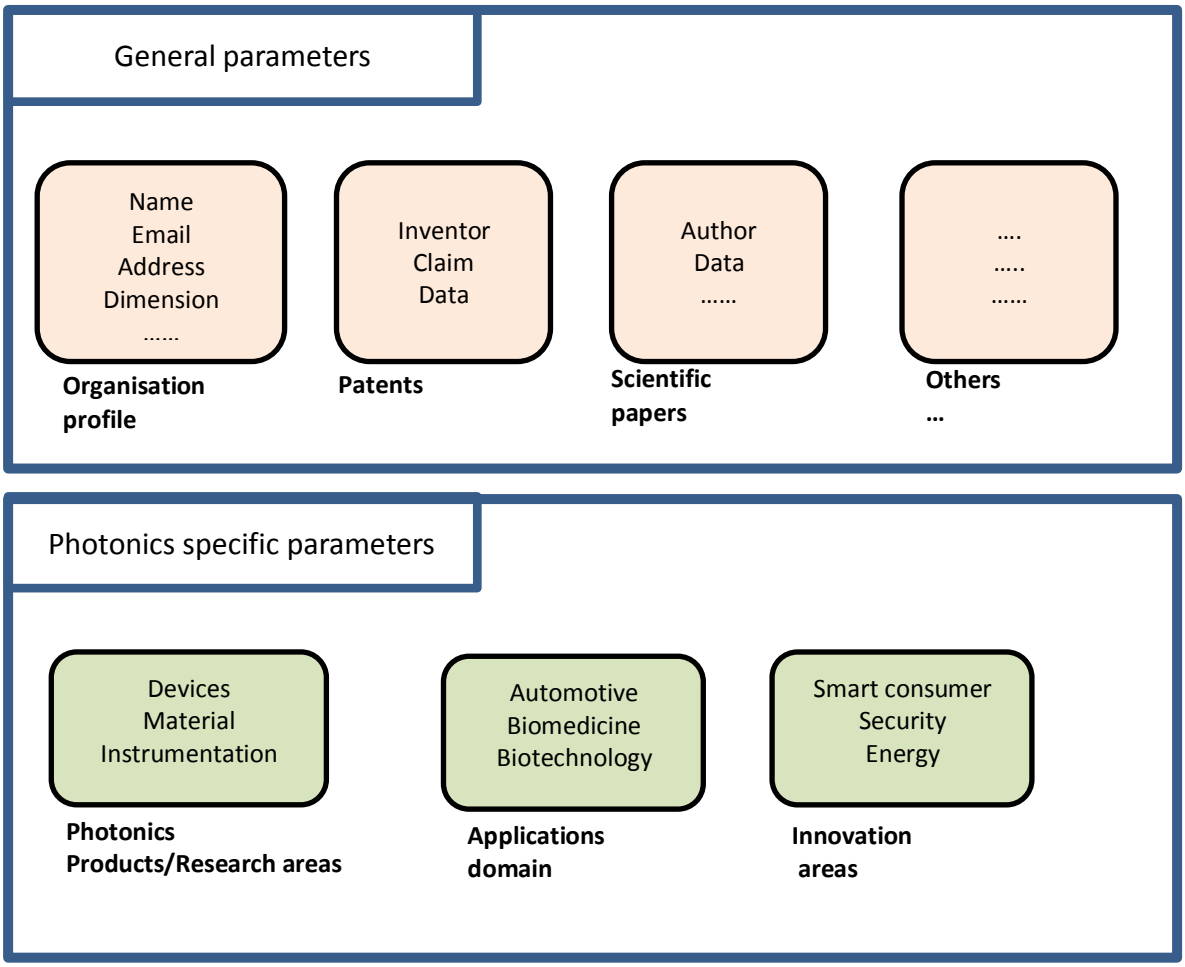

Figure 3 –Overview of the classification scheme.

5.1 General parameters

The general parameters have been drafted taking into account the main requirements of LightJumps of being capable to integrate the data sets of other organisations and to gather the necessary information to support the delivery of the LightJumps services.

In this document, the only "Organization profile" parameter is described (see Table 1), the others (patents, papers …) will be inserted in a standard manner in the LightJumps platform without any particular implementation related to the Photonics field. For this purpose, there is not a detailed description in this document.

Table 1. General parameters: Organization profile.

Value		Description
Id code		Identification code of the organization
Legal Organisation Name		Name of the organisation
Type of organisation		Type of organisation (values: 'Association', 'Cluster', 'Large sized company', 'Consulting', 'Magazine/Media', 'Research', 'University', University /Research', 'SME (Small or Medium sized Enterprise)', 'Non Commercial'; 'Other'
Geographical Location		It is the Country in which the organization or the headquarters of the company are located.
Address		Address comprehensive of Street, Street number, Postal code, City (ex. 'Tagus Park, 2781, Oeiras, PORTUGAL')
Website		Official Website of the organisations
Source		Source from which organisation is coming: LIGHTJUMPS, EPIC, PHOTONIC21, OTHERS.
Organisation description		The description of the organisation in terms of assets, technologies, products, etc.
Contact information	**Name**	Name, Surname and email of the main reference of the company
	Surname	
	E-mail	
Year founded		It is the year when the organization was founded
Links to other clusters or RTD entities		Name and references of clusters or RTD entities linked to the company.

5.2 Photonics specific parameters

The Photonics specific parameters are the following:

1) Product / Research areas (see Table 2);
2) Application domains (see Table 3);
3) Innovation areas (see Table 4).

Each of the Photonics specific parameters assumes a main value which is further decomposed in a subset of secondary values, used to better classify the variety of the input data.

Table 2. Product / Research areas.

Main value	Secondary value
General optics	Atom
	Coherent optics
	Colorimetry
	Diffractive optics
	Femtosecond and other laser processes
	high-speed and high dynamic range imaging
	Holography
	Label-free optical bio-sensing, time-resolved fluorescence detection
	Lasers
	Lasers applications
	Light Sources
	Light-matter interaction
	Micro Optics
	Micro Photonics
	Nonlinear optics
	Optical engineering
	Optical scientific computation and modelling
	Optical solitons
	optical spectrum
	Other
	Packaging of optical components
	Photodynamic processes and research
	Photo-induced processes
	Photo-ionisation
	Photoluminescence and fluorescence
	Photorefractive effects, devices and research
	Plasma research and applications
	Plasmonics
	Polarization related optical devices and research

	Quantum optics, devices and research
	Short-pulses generation and characterization
	Signal and image processing
	Surface laser processing of ceramics, glass, metals and polymers
	Theoretical optics and photonics
	Ultrafast optics
Optical technologies	Detectors
	Displays
	Optical sources in infrared, visible, UV, X optical
	Optoelectronics
	Packaging of optical components
	Sol-gel optics and technologies
	Sources of X-radiation by plasmas
	Spectrum
	X-ray detectors
Instrumentation	4D microscopy
	Cameras
	Information Storage
	Optical instrumentation
	Optical instrumentation and systems
	Optical measurement systems and sensors
	Photon-counting
	Signal and image processing
	Spectacles
	Spectroscopy
	Terahertz spectroscopy
	Test & Measurement Systems
Optical devices	Active optical devices
	Adaptive optics
	CMOS image sensors
	Optical Components
	Optical components and devices
	Optical design
	Optical design and modelization
	Optical diagnostic and control
	Optical diodes
	Optical fibre devices and research
	Optical fibre devices and sensors
	Optical imaging
	Optical interconnects
	Optical Manufacturing Equipment
	Optical microscopy
	Optical packaging
	Optical parametric processes and devices

	Optical sensors
	Passive optical components
	Photonic crystals
	Photonic hybrid architectures
	Photonic integration
	Photonic lightwave circuits
	Rare earth-based devices and research
	Semiconductors materials, processes, devices
Optical materials	Coatings
	Fiber Optics
	Glass & Other Optical Materials
	Glasses and ceramics
	III-V and II-VI materials
	Laser microstructuring of materials
	Liquid crystals
	Nonlinear optical materials
	Optical data storage materials
	Other materials for optics and photonics
	Polymers and organic materials
	Silicon based materials
	Thin films and thin layers
Optical applications	Astronomy
	Automation
	Biophotonics
	Industrial processing
	Nanophotonics
	Nanophotonics
	Optical communications and networks
	Optical computing
	Optical data storage and processing
	Photovoltaic
	Research and develop new solid-state laser technologies
	Visual inspection

Table 3. Application domain.

Main value	Secondary value
Automotive	Night vision system
	Datacom bus system
	Sensor system
	Other
Biomedicine	Photonic enabled microfluid
	imaging guides
	sensor catheters

	RI sensors
	Opto-fluidics
	minimal invasive dignostic
	Treatment monitoring by imaging
	Retinal implants
	Microinstruments for early diagnostic of cancer
	Endomicroscopes for colonoscopy gastroscopy bronchoscopy
	Miniature OCT system
	Other
Biotechnology	Opto-fluidics
	Bio-chips
	Lab-on-chip system
	Point-of-care diagnostics
	Microcytometers
	µTAS devices
	Others
Communication	FTTH connectivity & components
	R2R, B2B,... Interconnects
	Optical interconnect systems
	DC fibres
	Amplifying fibres
	λ-stabilizers
	Other
Environmental monitoring	Strain sensors
	Temperature sensors
	Vibration sensors
	Chemical sensors
	Other
Green energy	Solar energy harvesting
	Lighting
	Other
Home automation	IR remote control
	Fingerprint sensors
	Retinal scanners
	Safety labels
	Security systems
	Other
Information technology	Micro displays
	Cameras
	Scanners
	Projectors
	Printers
	Other
Laser machining	High power fibres

	LMA fibres
	Doped fibres
	Low bend loss fibres
	Other
Lighting	OLED
	Light guiding surfaces
	Intelligent lighting
	Other
Manufacturing	Machine vision systems
	Distance sensors
	Optical encoders
	Laser beam coupling and beam-shaping
	Lithography and digital printing
	Other
Multimedia	LED based projection
	Advanced displays
	Mobile devices
	3D camera systems
	Microdisplays
	Scanners
	Barcode readers
	SLMS
	Micro-projectors
	Micro-cameras
	HMDs
	Switches
	Other
Optical metrology	Miniature confocal microscopes
	Microinterferometers
	Industrial endoscopes
	Micro-spectrometers
	Other
Sensors and security	IR optics
	Nightvision systems
	Thermal cameras
	Other
Smart optical system	Spectrophotometers
	Wireless remote optical monitoring sensors
	Other
Spectroscopy	Supercontinuum sources
	Large core fibres
	UV-VIS-NIR fibres
	λ-filters
	Other

Table 4. Innovation areas

Main value	Secondary value
Effect Based (approach to security) operations	Directed Energy Weapons
Efficient and Effective healthcare and cure	Consumer electronics for healthcare
	Targeted drug treatment
	Transplantation of Tissue and Organs
	Utilities for Early Diagnostics
	Advanced therapies and therapeutic tools
High-Tech Product manufacturing	Rapid Prototyping/Rapid manufacturing
	Laser material processing
	Optical manufacturing equipment
	Semi-conductor component manufacturing
	Smart testing and analysis facilities
Homeland security system	Surveillance Systems
	Forensic methods
	Automatic Identification Systems
Novel energy systems and concepts	Photovoltaic solar energy
	Nuclear fusion
	Solar thermal energy
Scientific Instruments laboratory	Particle physics instruments
	Scientific instruments
Smart consumer products	Advanced digital cameras
	(Personalised) Opthalmic systems
	Smart clothing
	Fast and reliable networks
	Optical computer products
	Next generation displays
Sustainable agriculture efficient	Precision farming
	Greenhouse agriculture
Sustainable living environment	Monitoring systems for building and construction
	Environmental monitoring systems
Sustainable transport and logistics	Night vision systems
	Navigation systems
Utilization of space and deep Sea	Astronomy and planetary probes
	Earth observations systems

6 Conclusions

The LightJumps classification scheme has been designed on the basis of the already available classifications, taxonomies, and results of research projects.

The classification scheme realised is aimed at achieving a twofold objective:

- Support the data import and integration in a single database of different data sets that can be provided by organisations operating in the Photonics sector;
- A web tool easy to access for classifying organisations, but also any other information that can be stored and accessed through the LightJumps knowledge base.

The resulting classification scheme is based on a set of general parameters that can be used to tag any type of data relevant for the scope of the LightJumps project, namely the organisations but also documents, projects, papers, etc. The classification scheme also considers Photonics specific parameters such as the Products/Research areas, the Application Domains, and the Innovation Areas, which are described through a main value (main classification Tag) and a secondary value (secondary classification Tag). At the second level, more than 220 classification tags relate to Photonics have been defined to categorise the information.

The overall approach for data import and mapping was also focused in integrating already available data sets of EPIC and PHOTONIC 21, to integrate the data of such organisations in LightJumps, and then make the data available (through RESTful services) to any organisations willing to query such integrated database.