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Deliverable 1.1

Development of innovation potential index for Photonics SMEs

Deliverable Name	Development of innovation potential index for Photonics SMEs
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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)	

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1. Introduction and the scope of the task

The following deliverable provides the results from Task 1.1 '*Definition of innovation potential and benchmarking of high-tech photonics SMEs'* which aimed to use the existing methodologies to select SMEs for the analysis in order to benchmark their innovation potential and identify the areas for the support that is needed to boost their growth potential.

The initial scope of the task was defined as following:

- RespiceSME will focus on high-tech SMEs, because these SMEs have existing innovation capabilities which can be improved by utilising the tools and participating in the activities throughout the duration of the project. This can lead to a measurable and increased (i) innovation potential and (ii) number of generated business collaborations through RespiceSME and beyond as it is required by the scope of the ICT-27c work programme;

- There is a need to create a set of measurable criteria that could be tracked over time and used for validating the impact of the RespiceSME actions individually and/or aggregated in a ranking list of targeted companies;

- Each partner representing a cluster organisation will have to analyse the innovation potential of at least 3 SMEs from each cluster region, preferably related to one of the targeted application markets, namely, environment/energy, transport and manufacturing sector.

The implementation of the task followed the procedure adopted during the kick-off meeting:

1. **Identifying and pre-selecting potential SMEs.** All partners prepared a list with potential SME candidates for the analysis. The lists ought to contain photonics companies active in the fields of environment/energy, transport and manufacturing sector. It was asked to provide a mixture of micro- and medium-sized SMEs. Each list had to contain at least 10 SMEs. To broaden the scope for the initial sampling it was allowed to nominate also photonics companies located outside of the respective cluster region/country, providing them closely working with the respective cluster organisations. The minimum number of proposed SMEs was set at 100. The list of pre-selected SMEs contained 177 entries (see Annex 2).

2. **Ranking and shortlisting the pre-selected SMEs**. The proposed companies were analysed following 3 indicators: 1. company age; 2. number of patents; 3. annual turnover using publicly available data such as data gathered from official company registers, company data aggregators such as hoovers.com, and/or dedicated business information sources. A multi-criteria ranking has been adopted to rank the companies based on the established decision criteria. No cap was established on the maximum number of SMEs to be shortlisted; the minimum requirement per partner was 3 SMEs. The final shortlist contains 39 companies (see Annex 3).

3. **Adapting the Potential Innovation Index (PII) methodology**. On the basis of the existing PII methodology the concept of the innovation measurement using a survey questionnaire has been prepared, incorporating also the SEZ/EEN questionnaire and some other existing tools for innovation measurement (such as Bluefin Elastic Innovation Index). The consolidated questionnaire template was prepared using the set of 56 closed questions which have been tested using real data inputted through the online surveying system on Google Forms. The data has been validated by analysing their statistical significance. A set of 6 closed-questions have been added in order to better capture additional aspects through qualitative data. The methodology is based on the assessment of the existence of the best innovation practices as related to the following operational functions: 1) Creativity and concept generation, 2) New product development, 3) Human resource management, 4) Technological strategy,

5) Project management, 6) Data and knowledge management, and 7) Understanding of value chain. This sub-task will be developed more in detail in the D1.2 'Innovation Audit tool to measure the innovation potential of high-tech photonics SMEs' presenting the tool and the results of the innovation audits.

The results of T1.1 are:

- A shortlist of 39 photonics SMEs from 10 participating cluster regions in Europe to be analyzed in depth through audits;
- The adopted, modified methodology for measuring the Potential Innovation Index to suite high-tech SMEs in general and high-tech photonics SMEs in particular;
- Preparation of a consolidated questionnaire, including 41 closed questions and 6 open questions, covering 7 areas for best innovation practices which are associated with innovative SMEs (D1.2).

2. Methodology used for the ranking of SMEs

The ranking of pre-selected SMEs was done by applying an innovative method for scoring multi-attribute value models, the PAPRIKA (Potentially All Pairwise RanKings of all possible Alternatives) method[1], developed by the team of researchers at the University of Otago (New Zealand). The method was implemented through the website 1000minds.com. The access to the website was made available for this analysis on the basis of a granted academic license.

The application of the PAPRIKA method was done as following:

- First, the data for each company (founding year, turnover, number of employees) are publicly available sources; a description of the main products and application markets came from LinkedIn, which was further corroborated with the information gained from individual company web pages and secondary sources gathered in a table on an Excel sheet (Annex 1);
- Second, 3 main criteria were selected to form the decision model to be applied on the dataset for multi-criteria decision-making using the PAPRIKA method, namely, criterion 1 - the main type of activity of the company in the value chain classified using the adopted typology of companies at PhotonicsSweden (sales, services, contract research, component development, system development – listed from the lowest ranked to the highest), criterion 2 – the number of patents and/or patent applications (estimated using the global patent aggregation portal (www.patentinspiration.com) ranked according the identified most common ranges of patent numbers (1-10, 11-20, 21-50, 51-100, above 100 – listed from the lowest ranked to the highest), criterion 3 – the SME status (start-up, micro, small and medium – listed from the lowest ranked to the highest). Further, 3 additional factors were included to compliment the analysis: a company age (a number of years since the company incorporation) , turnover (in MEUR) and a specific application market (a text description).
- Third, preference values were established using the PAPRIKA procedure implemented on 1000minds.com which consisted of a series of computer-generated questions based on choosing between two hypothetical alternatives defined on two criteria at a time and involving a trade-off. The answers determined the weights on the criteria, according to the preference value of its highest-ranked level. The answers provided were based on the assumptions made about the priorities in the analysis. The procedure resulted in the following weights (see the table below).

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[1] P Hansen & F Ombler (2008), "A new method for scoring multi-attribute value models using pairwise rankings of alternatives", Journal of Multi-Criteria Decision Analysis 15, 87-107.

Table 1: Normalized criterion weights and single criterion scores

Criterion	Criterion weight (sum to 1)	Level	Single criterion score (0-100)
Main type of activity	0.536	Sales	0.0
		Services	16.2
		Contract research	29.7
		Components	62.2
		Systems	100.0
SME status	0.246	Start-up	0.0
		Micro	29.4
		Small	35.3
		Medium	100.0
Number of patents	0.217	1-10	0.0
		11-20	6.7
		21-50	26.7
		51-100	86.7
		101-	100.0

- Fourth, preference values were used to rank alternatives (the pre-selected SMEs). Each SME was scored on the basis of weighted criteria (Annex 2) and 3 highest ranked SMEs from each cluster region were consolidated in the provisional shortlist.

- Finally, the provisional shortlist of SMEs was further validated by gathering additional first-hand information and using expert opinions from each cluster organisation, and the final list was composed (Annex 3).

The shortlisted companies are well distributed according to the company age (Figure 1). The sample represents a good mix of medium and smaller companies (Figure 2). Most of them are producing systems but the sample includes also companies that cover all other aspects of the value chain, including sales and services (Figure 3). The companies involved in the contract research are missing.

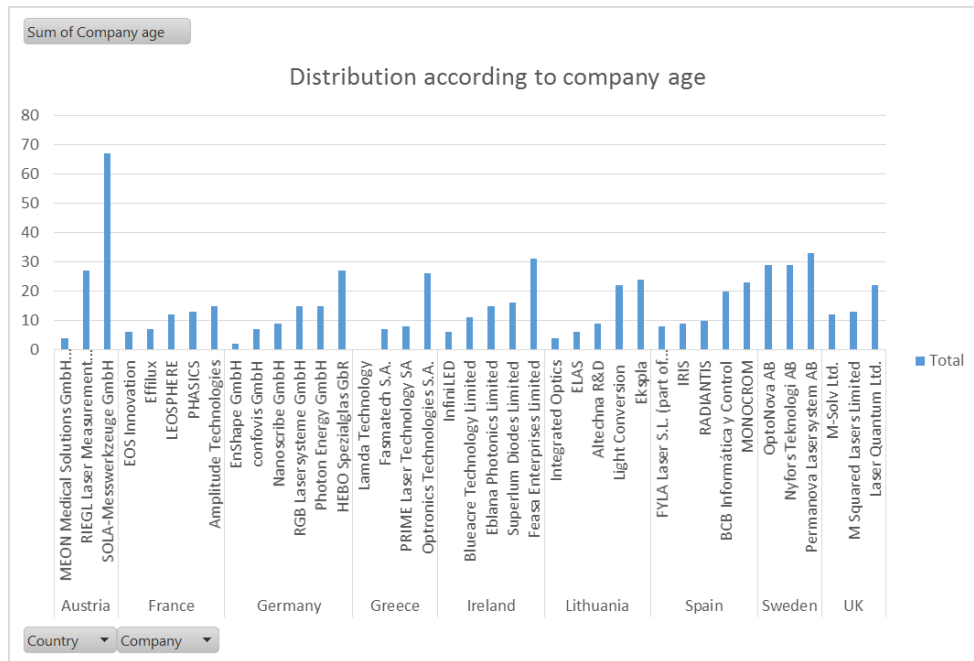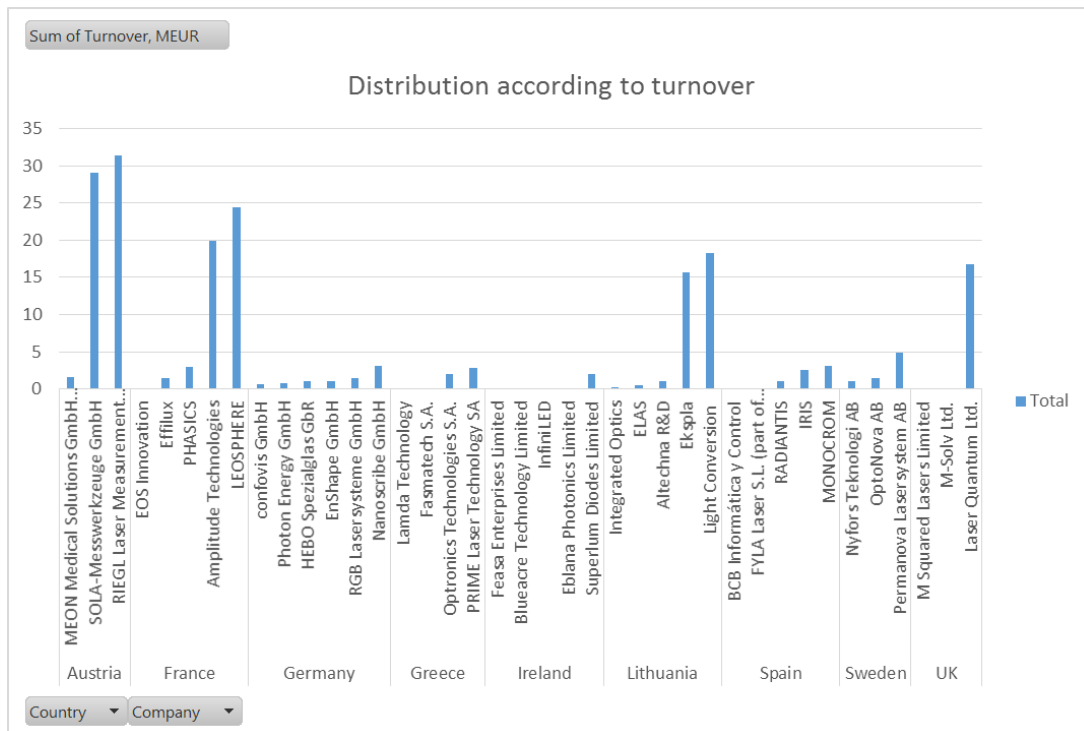*Figure 1: Distribution of shortlisted SMEs according to company age*

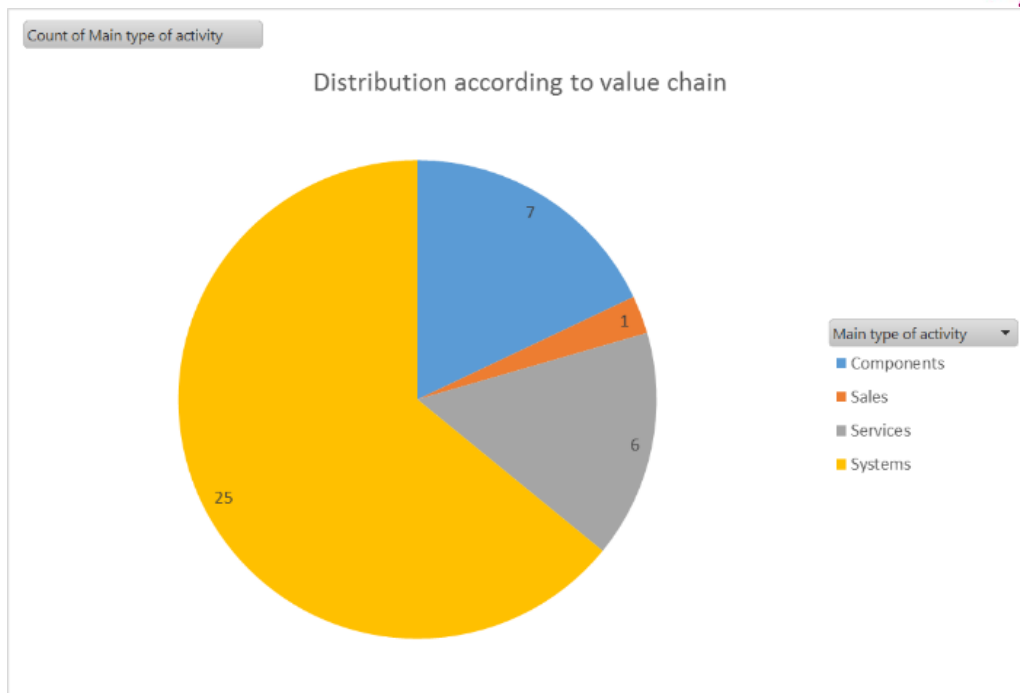*Figure 2: Distribution of shortlisted SMEs according to the turnover figures*

Figure 3: Distribution of the shortlisted SMEs according to their position on the value chain

3. Methodology of Potential Innovation Index

Two main issues have been considered for searching the suitable methodologies that could be adopted for the needs of the project. First, the issue of *what to measure* trying to understand what constitutes innovation capacity metrics in case of high-tech photonics SMEs. Second, the issue of *how to measure* trying to figure out which aggregation methods and computational algorithms should be used for the data analysis and visualization.

3.1. Innovation capacity criteria

A review of literature has shown that a number of approaches to measure innovation capacity at a company level are taken into account. **Innovation capacity** is defined as the *continuous improvement of the overall capabilities and resources that the firm possesses for exploring and exploiting opportunities to develop new products to meet market needs*[2]. It is a common understanding that the innovation capacity cannot be captured through the analysis of a single performance criterion and that a **multi-criteria model** is needed to measure the innovation capacity. Several authors have shown that this type of measurement requires the input of both qualitative and quantitative data used to analyse different aspects of the innovation capabilities[3]. The analysed capabilities included resource allocation, a capability to foresee technological changes and manufacture new products using appropriate technological processes, a capability to organize an inner learning process and so on. The underlying assumption in all those studies was that innovation capacity was directly linked to absorptive capacity which has been defined as a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capability[4]. It is understood that by investing in certain activities, which could be identified as innovation practices, companies can improve their ability to identify, value, assimilate and apply an available knowledge developed outside of the company[5].

In order to measure different level of innovation capacity the model of the **Potential Innovation Index** was introduced and further developed by Boly, Corona, Assiélou as part of the major team effort in this field at ERPI (Équipe de Recherche sur les Processus Innovatifs) at the University of Lorain. A general referential framework of internal innovative practices for the innovative company has been proposed.[6] The framework consisted of a list of **six main areas for innovation practice** which has been preliminary adopted for the purpose of this project, namely 1) Creativity and concept generation, 2) New product development, 3) Human resources management, 4) Technological strategy, 5) Project management and 6) Data and knowledge management. Each aspect was covered by three questions, each evaluated on a Likert scale with proposed weights for each group of criteria. Boly has further expanded the methodology by increasing the number of the innovation practice areas to 15, including design, project management, integrated strategy, project portfolio management, suitable organisation, innovation process improvement, competences management, moral support, knowledge management, competitive technology intelligence, network management, collective learning, ideas and creativity, R&D activities and customer relation management[7]. His assumption was that innovative companies develop all or any innovation practices with more or less relevance and in a formal or informal manner. The degree of development of these practices makes it possible to determine the innovation capacity of a company and its mastery level of

[2] *Szeto, E., 2000. Innovation capacity: working towards a mechanism for improvinginnovation within an inter-organizational network. The TQM Magazine 12 (2),149–157.*

[3] *Guan, J.C., Yam, R.C.M., Mok, C.K., Ma, N., 2006. A study of the relationship betweencompetitiveness and technological innovation capability based on DEA models.European Journal of Operational Research 170 (3), 971–986.*

[4] *Zahra, S.A., George, G., 2002. Absorptive capacity: A review, reconceptualization, andextension. Academy of Management Review 27 (2), 185–203*

[5] *Fabrizio, R.K., 2009. Absorptive capacity and the search for innovation. ResearchPolicy 38, 255–267.*

[6] *Daniel Galvez, Mauricio Camargo, Julio Rodriguez, Laure Morel, PII- Potential Innovation Index: a Tool to Benchmark Innovation Capabilities in International Context, J. Technol. Manag. Innov. 2013, Volume 8, Issue 4, 36-45*

[7] *Boly et al., Evaluating innovative processes in French firms: Methodological proposition for firm innovation capacity evaluation, Research Policy 43 (2014) 608–622.*

the innovation process. Hence, instead of trying to qualitatively evaluate the level of each innovation practice aspect (the process which is always prone to a subjective treatment of the observables) Boly proposed to measure the practices either by noting their existence or their absence, thus providing a possibility for a more robust model using quantitative data as an output.

While adopting Boly's proposed Potential Innovation Index methodology, RespiceSME consortium has narrowed down the innovation practices to **7 areas** which, having consulted with the industry experts, identified as the most suitable to capture the innovative potential of high-tech photonics SMEs. This was done by collecting the key characteristics of the key-performing SMEs which could be used to benchmark the rest. The list of characteristics and the corresponding questions covering individual innovation practices to be used for the planned PII survey questionnaire are presented in the table below.

Innovation practice area	Issues relevant for the high-tech photonic SMEs	Aspects to be analysed in the PII survey
Ideas, creation and creativity	Need to formalize and streamline the idea generation for new R&D activities and planned products in specific, highly specialized areas, the need to use the brainpower scattered across different functions	• Ideas collection from staff from R&D and marketing functions • Creativity groups • Formalized procedures to collect ideas within the company • Meetings dedicated to idea generation involving staff from R&D and marketing functions • Dedicated resources to keep track of existing and new ideas • A formalized assessment process to evaluate new ideas
Design and new product	Need to adapt practices, often introduced by external facilitators and experts, to design new products according to the set of rules in a highly complex and often very customized product pipeline, which is difficult to replicate or scale up especially in smaller companies working on customized solutions.	• Regular meetings to monitor new product development activities take place • Regular reviews of tasks of all project teams and managers • Use of facilitator groups or individual • Use of formalized design methodologies or tools for new product development • Availability of prototyping facilities (such as a laboratory or a test bed) in-house • Implementation of quality and assurance processes
Competences management	Need to improve the skill base in the company while keeping a track of what skills could be required within a short-term period given the fact that often the skills needed are extremely specific and their supply on the market is limited.	• Technological training on a regular basis • Staff employment strategies according to skills needed for future projects • Mapping of individual competences for use in innovation management • Formation of cross-functional teams to perform project-driven activities • Function of a human resource manager
Competitive technology intelligence	Need to keep an eye on the latest technological developments by incentivizing staff to gather and share information, by collecting data in a structured manner and using the	• The process for technology intelligence gathering • Incentives to actively participate in the technology intelligence gathering • Use of data collection methodologies and

	internal organizational structures to transform those bits of information into potential leads.	tools for the market survey • Meetings to transform collected information into innovation projects • Planning and preparation of visits (exhibitions, trade shows etc.) in advance
Project management	Need to keep on track with delivering projects while making sure that the project management process is flexible and adaptive to the changing demands of the customer and includes the risk mitigation measures in the case of highly customized solutions which have a strong service element attached.	• Availability of regular progress reports for each project • Availability of well-defined planning boards available for tracking project progress • Availability of an initial reference frame established (objectives, responsibilities, budgets) for each project • Continuous resource monitoring (materials, financial, personnel) assigned to each project • Use of project management and/or task tracking software
Knowledge management	Need to implement internal systems backed up by knowledge management processes in order to make available sensitive information for a safe retrieval and further use without jeopardizing the know-how by revealing it to competitors. Hence, the big question is what to make available and how, and what levels of access should be introduced.	• Use of a dedicated system or tool for recording know-how and re-use of previous knowledge • Processing of (codification, classification) before storing • Implementation of procedures for creating and maintaining intellectual property • A regular staff appraisal procedure at an individual or team level • Use of knowledge management tools such as centralised intranet portals or repositories
Value chain analysis	Need to identify the value chains in order to better position oneself within the market space and create a more sustainable business model, which is challenging given the fact that photonics is a general purpose technology which has a wide variety of applications, so the company involvement in the value chains tends to be overstretched with a lack of a strategic depth. Hence, the need to have in-house capacities to constantly analyse different value chains and make strategic adjustments accordingly.	• A clear understanding of the value chain which encompasses products, processes, or service • Analysis of the contributors (research partners, suppliers, advisors) that help you provide product, process, or service • Identification of the different stakeholders who could most effectively exploit, apply, or extract value from your product, process, or service? • Recognition of the technology readiness levels of the various elements of the value chain in which a specific product or process contributes • A systematic approach to identify what part of the value chain has the greatest potential for innovation or development

The proposed PII index will be evaluated through a series of closed questions covering the innovation practices relevant to the photonic SMEs which will be scored and weighted using both standard and harmonic averages. The cumulative weighted scores will be used to define the overall levels that have acute need for support and intervention in order to boost the absorptive capacity of individual companies.

3.2. Measurement techniques

Most of the proposed approaches on the innovation capacity metrics are based on the evaluation of multiple factors. Hence, a number of multi-criteria decision aid (MCDA) techniques developed for the needs of the operational research have been applied on a case by case basis, including such MCDA techniques as ELECTRA, Weighted Averages, Analytic Hierarchical Process (AHP), fuzzy integrals, parametric identification, or Data Envelopment Analysis (DEA) and others. However, no unified and widely accepted approach has emerged so far. The main disadvantage of those techniques is the difficulty in making the results comprehensible and operational for decision makers. Hence, several attempts have been made to use the algorithms developed for visualization of MCDA output data. For the needs of RespiceSME the PROMETHEE (Preference Ranking Organization METHod for the Enrichment of Evaluations) and GAIA (Graphical Analysis for Interactive Aid) MCDA methods have been used which were implemented in the software Visual Promethee by Bertrand Mareschal at the Free University of Brussels[8]. The PROMETHEE and GAIA methods are among the most widely used multi-criteria decision aid methods[9]. The PROMETHEE technique is based on pair-wise comparisons and includes the following process: first, a unique criterion preference degree for every pair of alternatives is computed, second, a global preference degree for every pair of alternatives is computed and a preference matrix is created, third, positive, negative and net flow scores are computed. The GAIA technique takes the inputs from the PROMETHEE and uses each alternative to represent it as a vector, and then runs a principle component analysis on each vector by transforming the multi-dimensional vector space into two dimensions which are then visualised on a 2D plane with the indicated criteria as vectors and the calculated „decision stick" vector indicating the potential decision priorities. The obtained 2D plane using the above techniques then could be used for creating a 2-criteria decision support matrix using the existent typologies, such as Gartner's Magic Quadrant, which is widely accepted in the technology marketing. A Gartner Magic Quadrant provides a graphical competitive positioning of technology providers in a specific market where market growth is high and provider differentiation is distinct[10]. The matrix is based on quantified two criteria: 1) ability to execute and 2) completeness of vision.

The output is the profiling of companies according to the following definitions:

- **Leaders** execute well against their current vision and are well positioned for tomorrow.
- **Visionaries** understand where the market is going or have a vision for changing market rules, but do not yet execute well.
- **Niche Players** focus successfully on a small segment, or are unfocused and do not out-innovate or outperform others.
- **Challengers** execute well today or may dominate a large segment, but do not demonstrate an understanding of market direction.

For the purpose of RespiceSME, the quantitative data about each company and its performance which were used for sampling companies (such as turnover, number of staff, number of patents and/or patent applications) could be potentially used for estimating a relevant score corresponding to the one measured by Gartner under "ability to execute", while the Potential Innovation Index calculated as a weighted sum of the PII survey criteria could be used for estimating a relevant score corresponding to the one measured by Gartner under "completeness of vision". The decision concerning the exact design of visualization of the output will be made based on the needs of the companies that will be audited.

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[8] http://www.promethee-gaia.net/; cf. S.Greco, M.Ehrgott, J.R.Figuera, Multiple Criteria Decision Analysis: A State of the Art Surveys, 2nd ed. (Springer, 2016).

[9] Behzadian, M.; Kazemzadeh, R.B.; Albadvi, A.; Aghdasi, M. (2010) « PROMETHEE: A comprehensive literature review on methodologies and applications », EJOR, Vol.200(1),198-215

[10] http://www.gartner.com/technology/research/methodologies/research_mq.jsp

3. Annexes

Annex 1: Overall list of ranked SMEs

Company	Country	Value chain	Main types of products	Application markets
Alter Technology	Spain	Services	Destructive physical analysis (DPA), Failure analysis, Testing and measurement, Radiation testing (total dose & heavy ions), Procurement, Project management, Engineering consultancy, Equipment certification, EMC	Aviation & Aerospace
BCB Informática y Control	Spain	Systems	Machine vision, Automatic Test Equipments, National Instruments' integrations, Automatic Heliostat Calibration, Equipments for laboratories&educational purposes, Data acquisition&sensor integration, Software for industrial and scientific purposes, IR thermography	Industrial Automation
CA ASOCIADOS	Spain	Components	specialty optics, optical components	Research
FYLA Laser S.L. (part of EUROTREND holding)	Spain	Systems	In-Fibre Laser Research, Design & Manufacturing, Supercontinuum Lasers, Pico and Femto In-fibre Laser, Laser as a Service	Machinery
IRIS	Spain	Systems	handheld NIR analysers	Industrial Automation
JEANOLOGIA	Spain	Systems	sustainable solutions for the garment finishing, ozone technologies, laser engraving, customization in the stores, laser industrial for OEM, sustainable technologies, consultancy, nano bubbles technologies, garment finishing	Apparel & Fashion
KDPOF	Spain	Components	Large Core Optical Fibres, Plastic Optical fibre, Information Theory, Digital Signal Processing, Digital and Mixed-Signal Semiconductors, Digital Communications Technologies	Semiconductors
LPI EUROPE	Spain	Systems	CPV	Renewables & Environment
LUZ WAVELABS SL	Spain	Systems	Ultra-low phase noise Terahertz (THz) photonic generation solutions, Photonics, optoelectronics and Terahertz consulting services, Compact and tunable Optical Frequency Comb Generators, Terahertz Spectroscopy, Non-destructive Testing, Material Characterization	Research

Company	Country	Value chain	Main types of products	Application markets
MONOCROM	Spain	Systems	Laser diode modules, High power diode lasers, Solid state lasers, Laser drivers, Pumping heads	
NIT	Spain	Components	infrared technologies, cameras for defence	
PROTON LASER APPLICATIONS SL	Spain	Components	pump laser systems	
RADIANTIS	Spain	Components	Optical Parametric Oscillators, Harmonic Generators, Spectrometer, Instrumentation, Ultrafast Laser Systems	Electrical/Electronic Manufacturing
RBZ Embedded Logics	Spain	Components	hardware and software for electronics	
SENSOFAR	Spain	Services	Surface Metrology, Optical Metrology, Confocal and Interferometry profiling, Non-contact 3D measurement, Stent inspection, Focus variation	Research
5microns GmbH	Germany	Components	Consulting of microsystem newcomers and experts, Research and development of microsystems, Microfabrication, Characterisation of microsystems	
ADVA Optical Networking SE	Germany	Services	Optical Transport, Ethernet Access, Network Management, Services	
Class 5 Photonics GmbH	Germany	Components	Ultrafast optical parametric chirped-pulse amplifier	
Collischon Optik Design	Germany	Services	development of specialty optics	
confovis GmbH	Germany	Systems	measurement systems	Semiconductors
Cube Optics AG (now HUBER+SUHNER Cube Optics AG)	Germany	Components	fibre-optic components, multi-lambda Receiver / Transmitter, DWDM, CWDM, WDM, Microinjection Moulding, Passive Assembly, Optical Sub-Assemblies (ROSAs / TOSAs)	Telecommunications
eagleyard Photonics GmbH	Germany	Components	Single Mode Laser Diodes, Single Frequency Laser Diodes, Tapered Amplifier, Multimode Laser Diodes, Gain Chips	Semiconductors
EnShape GmbH	Germany	Systems	3D sensor scanners	
GD Optical	Germany	Components	Coatings; Optical Components	

Company	Country	Value chain	Main types of products	Application markets
Competence GmbH				
HarzOptics GmbH	Germany	Contract research	optics	Research
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
HEBO Spezialglas GbR	Germany	Components	optical components, specialty optics	
ilis GmbH	Germany	Services	Test & Measurement Systems	
INNOVAVENT GmbH (part of Jenoptik)	Germany	Systems	Laser-Optics-Systems for crystallization, annealing and doping applications of semiconductors	Mechanical or Industrial Engineering
Jos. Schneider Optische Werke GmbH	Germany	Systems	optics	Machinery
LASER COMPONENTS GmbH	Germany	Components	Photodiodes, IR Components, Laser Diodes, Laser Modules, Measurement Devices, Fibre Optics, Laser Optics, Laser Accessories, In-house Production	Electrical/Electronic Manufacturing
Laser- und Medizin-Technologie GmbH Berlin	Germany	Contract research	Biomedical Optics , biophotonics , micro material processing , medical technology , sensor technology , spectroscopic methods , fibre optic diffusers , laser power monitoring	Research
LaserTechs e.K.	Germany	Components	Laser Diode Modules, Line lasers, Cross generating lasers, Positioning lasers	Electrical/Electronic Manufacturing
LEONI Fibre Optics GmbH	Germany	Components	Fibre Optics	Medical Devices
LMB Automation GmbH	Germany	Components	laser work stations	Industrial Automation
Microliquids GmbH	Germany	Components	modular turn-key systems to run liquid micro jets under vacuum conditions	Research
nanofluor GmbH	Germany	Components	Nanoscopic Metal Fluoride Sols	Research
Nanoscribe GmbH	Germany	Systems	Nanotechnology, 3D Printing, Micro Lithography, Maskless Optical Lithography Systems, Direct Write Lithography, Life Sciences, MEMS, Micro Fluidics, Micro Optics, Micro Rapid Prototyping	Research
Optics Balzers Jena GmbH	Germany	Components	optical coatings and components	Semiconductors

Company	Country	Value chain	Main types of products	Application markets
Photon Energy GmbH	Germany	Systems	3D laser lithography systems	Research
RGB Lasersysteme GmbH	Germany	Systems	laser and spectroscopy systems f	Research

Company	Country	Value chain	Main types of products	Application markets
RoodMicrotec GmbH	Germany	Services	Test Engineering, Product Engineering, Reverse Engineering, Reliabilty, Qualification, ESD Consulting, Failure Analysis, Supply Chain Management	Semiconductors
Vision Lasertechnik für Forschung und Industrie GmbH	Germany	Systems	Laser technology , special equipment manufacturing, mechanical engineering , medical lasers	Mechanical or Industrial Engineering
Optocap	UK	Services	Fibre Optics; Lasers; Test & Measurement Systems	Electrical/Electronic Manufacturing
Seren Photonics	UK	Contract research	Processing technology of HBLED structures	Semiconductors
Xcam Ltd	UK	Systems	"Tailor made CCD systems, CCD - scientific - Ultraviolet - UV - imaging . Bespoke charge coupled device scientific applications.	Electrical/Electronic Manufacturing
Advanced Fibreoptic Engineering	UK	Components	CCD cameras and arrays designed for scientific purposes	Electrical/Electronic Manufacturing
Element Six Ltd (Part of De Beers SA)	UK	Services	UV imaging with high spatial resolution."	Mechanical or Industrial Engineering
Fibrecore Ltd.	UK	Contract research	"design and manufacture, fibre optics, custom packaging, patch cords, fibre stubs, bespoke fibre assemblies, telecommunications, instrumentation, medical, defence and aerospace, prototypes. Advanced Fibre optic Engineering Ltd (AFE) designs and manufactures fibre optic solutions to meet specific customer requirements. We specialise in high performance products and can supply prototypes through to high volume. We supply industry leaders in the following market sectors: Telecommunications, Instrumentation, Medical, Defence and Aerospace. Can also supply custom packaging for customer's own components. Supplies custom patch cords, fibre stubs and other bespoke fibre assemblies (including spliced fibre arrays) Also offers bespoke fibre optic assemblies	

Company	Country	Value chain	Main types of products	Application markets
			for many different applications. Ability to supply prototypes from in-house workshop.	
Intellisense (part of Corning)	UK	Contract research	."	Semiconductors
Kromek Group Plc	UK	Systems	Synthetic diamond super materials and their processing	Security and investigations
Company	Country	Value chain	Main types of products	Application markets
Laser Quantum Ltd.	UK	Systems	optical fibre fabrication, speciality fibre, bend-insensitive single mode fibre, fibre optic gyroscopes, high power FTTx amplifier applications.. Fibrecore have 25 years' experience exclusively manufacturing specialty single mode fibres, and were the first company in the World to offer commercially available Polarization Maintaining, Erbium Doped, Er/Yb Co-Doped, Photosensitive and All-Silica Double Clad fibres..	Mechanical or Industrial Engineering
M-Solv Ltd.	UK	Systems	MEMS modules	Machinery
Michelson Diagnostics Ltd.	UK	Systems	Nuclear Detection, Security Screening, Medical Imaging	Medical Devices
M Squared Lasers Limited	UK	Systems	DPSS lasers, Ultrafast lasers, Ultrafast amplifiers, THz time domain spectrometers, Pulse characterization equipment, Ultrafast laser optics	Electrical/Electronic Manufacturing
OpTek Systems LTD	UK	Services	Large Area Electronics, Advanced Packaging, Photovoltaic, Micro-Electronics	Electrical/Electronic Manufacturing
Raptor Photonics	UK	Services	Optical Coherence Tomography, Medical imaging technology, Diagnosis and monitoring of skin conditions	Electrical/Electronic Manufacturing
Solaris Photonics	UK	Services	Ultra-narrow linewidth lasers, Ultrashort pulse lasers, IR and THz OPOs, Ti:Sapphire lasers	Renewables & Environment
Spectrum Technologies Plc	UK	Services	Laser Micromachining, fibre Optic - Strip, Cleave, Lens, Machine Tools, Job Shop, Contract Manufacturing, Automation	Aviation & Aerospace
Stratophase LTD	UK	Systems	Homeland Security, Low Light Surveillance, Life Science and Analytical Instrumentation, Scientific Research	Pharmaceuticals
Yelo LTD (Yelo Test Systems)	UK	Systems	Solar PV systems	Electrical/Electronic Manufacturing

Laser Micromachining Ltd	UK	Services	laser wire processing, laser wire marking equipment, laser wire stripping equipment, magnet wire stripping, measure & cut systems, fine wire & cable stripping, contrast measurement systems, automation solutions, sub-contract services, bespoke laser systems	Electrical/Electronic Manufacturing

Company	Country	Value chain	Main types of products	Application markets
Ekspla	Lithuania	Systems	Process instrumentation, Process measurement, In-line process monitoring, Real time analytics, Process analytic technology, Automated Feeding Control, Optimising Feeding Strategy, Mammalian Cell Bioprocessing	Mechanical or Industrial Engineering
Light Conversion	Lithuania	Systems	Printed Circuit Board Automated Test Equipment, Laser Diode Test & Photonics Reliability Test Equipment, Travelling Wave Tube Test Equipment, Contract Test Engineering Services LabVIEW Test stand	Electrical/Electronic Manufacturing
ELAS	Lithuania	Systems		
Altechna R&D	Lithuania	Components	high performance solid state lasers, optoelectronics and laser systems for various scientific, OEM and industrial applications: spectroscopy, material research, satellite ranging, material processing, micromachining.	
Integrated Optics	Lithuania	Systems	Lasers, Laser systems, Optical parametric amplifiers	Mechanical or Industrial Engineering
Standa	Lithuania	Components	Developer & manufacturer of laser systems for micro machining	
Brolis Semiconductors	Lithuania	Components	Developer of optical components and laser applications	Semiconductors
Lifodas	Lithuania	Components	Laser source production, Electronics production and development, Optics integration and miniaturization, Custom solutions	Electrical/Electronic Manufacturing
Eksma Optics (Optolita)	Lithuania	Components	Developer & manufacturer of fine mechanics & micro laser systems	Research
Lidaris	Lithuania	Services	Molecular beam epitaxy, Semiconductors, Laser diodes, Infrared, antimonides, arsenides, Epi-	Research

Company	Country	Value chain	Main types of products	Application markets
			foundry service	
National Energetics Inc	Lithuania	Services	LED and laser modules, fibre optic testing equipment	Research
LEDigma	Lithuania	Contract research	Polishing and grinding of flat optical components, Quality inspection of optical components, Polishing of DKDP, LBO, ZnGeP2 crystals, Manufacturing and assembling of Pockels cells	Research
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
Quantum Light Instruments	Lithuania	Systems	Laser Damage Testing, Optical Scattering, Laser Induced Damage Threshold	Research
Femtika	Lithuania	Contract research	high peak power lasers	Nanotechnology
Sprana	Lithuania	Components	technology of tetrachromatic light source	Mechanical or Industrial Engineering
Evana Technologies	Lithuania	Components	laser systems	
Arginta (part of Arginta Group)	Lithuania	Services	3D Nano Fabrication, Two Photon Polymerization, Micro sub-micro scales, Software for 3D processing	Mechanical or Industrial Engineering
Optida	Lithuania	Components	industrial analysers	Electrical/Electronic Manufacturing
Optogama	Lithuania	Services	optical modules for laser microfabrication	
Optonas	Lithuania	Components	engineering services	Semiconductors
Cellavision AB	Sweden	Systems	Optical coating services, Laser optic, Ultrafast optics, Custom development, Metallic High-Reflection coatings, Filter Coating Services, Polarizing Coating Services, Beam-Splitting Coating Services, Antireflection Coating Services, Express Coating	Medical Devices
Clinical Laserthermia Systems AB	Sweden	Contract research	laser sources, crystal materials, components, contract manufacturing services	Research
Excillum AB	Sweden	Components	optical coatings and components	Mechanical or Industrial Engineering
Fibresystem AB	Sweden	Systems	Image analysis, artificial intelligence, automated	Information Technology and

Company	Country	Value chain	Main types of products	Application markets
			microscopy	Services
Flatfrog Laboratories AB	Sweden	Components		Consumer Electronics
GASPOROX AB	Sweden	Systems	X-ray tubes, X-ray, E-beam technology, Electron optics, X-ray sources	Packaging and Containers
Heliospectra AB	Sweden	Systems	Design and development of secured systems for defence and government organisations, Design and development of fibre optic communication solutions	Biotechnology
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
Irnova AB	Sweden	Components	Touch screen technology, Pressure Detection, Multi-touch, Optical Clarity	Semiconductors
LIMAB AB	Sweden	Systems	instruments and services for truly non-intrusive measurement of gases in packages	Industrial Automation
Masimo Sweden AB	Sweden	Systems	LED light system technologies, Plant science, LED grow lights	Medical Devices
Metric Industrial AB	Sweden	Sales	IR detectors and related components	Industrial Automation
Midsummer AB	Sweden	Components	Development, production, sales and service of laser based distance measurement sensors and systems	Renewables & Environment
Northlab Photonics AB	Sweden	Services	Respiratory and Anesthesia Gas Monitoring	Telecommunications
Nyfors Teknologi AB	Sweden	Systems	Industrial Automation, Machine Vision, Sensors, Industrial IT, Industrial Communications, ID - Track & Trace	Industrial Automation
Obducat AB	Sweden	Components	CIGS Thinfilm Turnkey Supplier	Nanotechnology
Opsis AB	Sweden	Systems	fibre optic preparation tools and high performance fusion splicers	Electrical/Electronic Manufacturing
Optilia Instruments AB	Sweden	Systems	advanced fibre preparation equipment for high strength and specialty splicing operations.	Medical Devices
Optoga AB	Sweden	Components	Nanoimprint Lithography (NIL) and Electron Beam Recorder (EBR).SEM	Electrical/Electronic Manufacturing
OptoNova AB	Sweden	Systems	systems for gas analysis and process control	Industrial Automation
Optoskand AB	Sweden	Components	Visual Inspection Systems, Digital Capillaroscopy systems, High Definition Inspection Microscope	Mechanical or Industrial

Company	Country	Value chain	Main types of products	Application markets
			Cameras, Digital Dermoscopy systems, BGA Optical Inspection systems, Image Capture, Measurement and Analysis Software	Engineering
Perimed AB	Sweden	Systems	Develop and manufacture high CRI LED modules under the brand name of Optodrive for lighting industry	Medical Devices
Permanova Lasersystem AB	Sweden	Systems	Machine Vision, Quality inspection, Computer Vision	Industrial Automation
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
PiezoMotor AB	Sweden	Components	Fibre optics cables	Mechanical or Industrial Engineering
Proximion AB	Sweden	Components	instruments, software and expertise to enable assessment of the microcirculation.	Telecommunications
Qualisys AB	Sweden	Systems	Turn-key lasersystems	Electrical/Electronic Manufacturing
Rolling Optics AB	Sweden	Services	Piezoelectric Motor, Micro motor, Nanopositioning, Miniaturization, Motion Control, electric motor, Precision, Linear, Linjär, non-magnetic, ickemagnetisk, walking, piezo, piezoceramic	Nanotechnology
scint-x AB	Sweden	Components	optical modules and sub-systems based on Fibre Bragg Grating (FBG) technology	Medical Devices
Senseair AB	Sweden	Components	Motion capture systems, Industrial camera technology	Electrical/Electronic Manufacturing
SiTek Electro Optics AB	Sweden	Components	3D micro-optical foil for protection against counterfeiting	Semiconductors
SmartOptics Sverige AB	Sweden	Services	high resolution structured scintillators for x-ray indirect detectors	Telecommunications
Sol Voltaics AB	Sweden	Components	Infrared gas sensor technology, NDIR gas sensor manufacturer, Indoor climate and ventilation control, Cost-effective gas sensing production	Renewables & Environment
Eblana Photonics Limited	Ireland	Components	position sensing detectors	Semiconductors
Intune Networks Limited	Ireland	Components	Optical networking solutions	Telecommunications

Company	Country	Value chain	Main types of products	Application markets
Blueacre Technology Limited	Ireland	Services	Solarcell, Photovoltaics, Nanotechnology, Energy generation	Machinery
SensL Technologies Limited	Ireland	Components	Superior Laser Diodes for Sensing, Metrology & Comms	Medical Devices
FibrePulse Limited	Ireland	Components	ptical Ethernet switch fabric using tuneable lasers	Telecommunications
Dyoptyka	Ireland	Components	Laser Micromachining, Prototype Development, Laser Machining Systems, Product Engineering, Optical Systems, Microscope Design, Machine Vision Systems, Motion Control, CNC, Automated Materials Handling, Automated Part Inspections, Medical Devices, Semiconductors	Electrical/Electronic Manufacturing
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
Biosensia Limited	Ireland	Services	silicon photomultiplier technology, high volume detector fabrication, low cost photomultiplier tube replacement, R&D, sub-system design and fabrication	Medical Devices
ClearSight Innovations Limited	Ireland	Services	fibre optical patchcords	Medical Devices
Luxcel Biosciences Limited	Ireland	Components	Mirror modules with control electronics	Biotechnology
Radisens Diagnostics Limited	Ireland	Services	Point-of-Care in-vitro, diagnostics, Point-of Care testing, in vitro diagnostics, IV diagnostics, IVD, POC, multiplex testing, disease testing, diagnostics, point of care test, diagnosis	Medical Devices
VistaMed Limited	Ireland	Components	measurement of the eye for cathractic surgery	Medical Devices
Feasa Enterprises Limited	Ireland	Services	porphyrin-based, phosphorescent, oxygen-sensing probes and oxygen sensors	Electrical/Electronic Manufacturing
InfiniLED	Ireland	Components	point-of-care diagnostics	Semiconductors
Pie Photonics Limited	Ireland	Services	Medical Device, Catheters, Extrusion, Braiding and Coiling, Medical Balloons	Electrical/Electronic Manufacturing
Superlum Diodes Limited	Ireland	Components	LED Technology, Photonics, Calibration, Fibre Optics, Test and Measurement	Semiconductors
EcoCan	Austria	Components	Inorganic LED displays, Efficient LEDs, MicroLED Arrays	Electrical/Electronic Manufacturing
LUMITECH Produktion und Entwicklung GmbH	Austria	Systems	optical and photonic measurement technologies	Electrical/Electronic Manufacturing

Company	Country	Value chain	Main types of products	Application markets
Crystalsol	Austria	Contract research	Fibre Pigtailed Superluminescent Diodes, Free Space Superluminescent Diodes, Semiconductor Optical Amplifiers, Broadband Light Sources, Swept Broadband Light Sources, OEM Solutions, Customised Solutions	Renewables & Environment
Neulicht lighting solutions	Austria	Services	LED boosters	Renewables & Environment
SunnyBAG	Austria	Systems	LED lighting systems	Renewables & Environment
ecoliGhts SOLARE BELEUCHTUNG	Austria	Services	thin-film solar cells, a roll-to-roll technology	
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
Quantum Voltaics KG	Austria	Components	development of LED lightining solutions	
In-Vision Digital Imaging Optics	Austria	Services	solar integrated consumer articles, charges for mobile devices	
Trilite Technologies	Austria	Systems	development of user-taylored PV systems	Media Production
QuantaRed Technologies	Austria	Components	nanostructured glass for PV modules	Machinery
Crystalline Mirrors Solutions	Austria	Contract research	evelopment and manufacturing of optical systems and lenses	Research
Attophotonics Biosciences GmbH	Austria	Contract research	Autostereoscopic (glasses-free) 3D digital signage displays, RGB laser modules for pico projectors	Research
MONTFORT Laser GmbH	Austria	Components	Quantum Cascade Laser based Analyzers of liquids	Research
RHP - Technology GmbH & Co. KG	Austria	Services	development of low-noise reflective optics	Research
active photonics GmbH	Austria	Systems	development of nanotechnology, surface technology	Electrical/Electronic Manufacturing
Bartenbach Lichtlabor GmbH	Austria	Services	compact pulsed laser sources	Construction Industry
EVK DI Kerschhaggl GmbH	Austria	Components	hot pressing technologies, sputtering	Industrial Automation
MEON Medical Solutions GmbH & Co KG	Austria	Systems	thermovisors	Medical Devices

Company	Country	Value chain	Main types of products	Application markets
i-RED Infrarot Systeme GmbH	Austria	Sales	designing of lighting concepts	Industrial Automation
Lithoz GmbH	Austria	Services	hemical imaging technology based on near infrared (NIR) spectroscopy	Industrial Automation
RIEGL Laser Measurement Systems Gesellschaft m.b.H.	Austria	Systems	High precision gas mixing system for quality control and development of gas sensors, tonometer for quality control of blood gas analysers	Electrical/Electronic Manufacturing
SOLA-Messwerkzeuge GmbH	Austria	Systems	FTNIR / FTIR systems	Construction Industry
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
TecSense GmbH	Austria	Components	development and production of ceramic materials and additive manufacturing systems (3D printing)	Research
Plasmo Industrietechnik GmbH	Austria	Services	laser scanners, rangefinders and distance-meters	Industrial Automation
Fasmatech S.A.	Greece	Services	measuring instruments, line and point lasers for measurement	Electrical/Electronic Manufacturing
ThetaMetrisis S.A.	Greece	Systems	sensors with glass fibre optics	Research
PRIME Laser Technology SA	Greece	Services	Quality assurance , test and measurement systems , quality assurance and diagnosis systems , Industrial imaging processing , machine vision	Renewables & Environment
Optronics Technologies S.A.	Greece	Services	mass spectrometry, ion mobility spectrometry, electronics development, Ion optics design and characterisation, Atmospheric-vacuum ion interfaces, Custom MS devices	Telecommunications
Lamda Technology	Greece	Sales	optical metrology tools for the characterization of thin and thick films, the FR-Series	Telecommunications
Raymetrics S.A.	Greece	Services	laser welding technology for solar thermal absorbers	Research
THEON SENSORS S.A.	Greece	Systems	services in optoelectronics, lasers and fibre optics	Defense & Space
MILTECH HELLAS S.A	Greece	Systems	vendor and integrator of optical fibre cables, passibe optical elements	Defense & Space

Company	Country	Value chain	Main types of products	Application markets
Opticon Group ABEE	Greece	Services	aerosol LIDARs for atmospheric applications	Information Technology and Services
Brite Hellas S.A.	Greece	Components	Electro-Optics, MEMS, Night Vision Driver Viewers for Armoured vehicles and Main Battle Tanks	Renewables & Environment
Gounas P. - K. Enezlis O.E. cnc Solutions	Greece	Services	Manufacturing, Telecommunication Equipment Production, PCB Production Line, Aerospace Metal Parts Production, Cockpit Electronics, Electric Power Converters, Thermal Imaging Devices, Computer Assisted Exercises (CAX) & Simulation	Mechanical or Industrial Engineering
Amplitude Technologies	France	Systems	Thin-film laser processing, advanced optical data storage	Electrical/Electronic Manufacturing
ATERMES	France	Components	solar glass, DSCC ink-jet technology	Defense & Space
Company	**Country**	**Value chain**	**Main types of products**	**Application markets**
DIOTASOFT	France	Services	CNC processing	Industrial Automation
Effilux	France	Systems	Femtosecond laser, Petawatt, Terawatt, high power laser, high peak power laser, high temporal contrast	Machinery
EOS Innovation	France	Systems	Optical systems for reconnaissance	Electrical/Electronic Manufacturing
GREENFIELD TECHNOLOGY	France	Services	software solutions of augmented reality for manufacturers	
HOLOGRAM INDUSTRIES	France	Systems	LED lighting systems for machine vision, quality control, scientific imaging, biomedical	Security and investigations
Imagine Optic	France	Services	Robotics, security, surveillance, remote monitoring	
INNOV+	France	Services	Test & Measurement Systems	Transportation
LEOSPHERE	France	Components	Optical and digital security solutions to authenticate currency, passports / national ID's, vehicle registrations and global brands	Renewables & Environment
PHASICS	France	Services	avefront analysis and adaptive optics products & solutions for lasers and microscopy	Research
PRAGMADEV	France	Services	river vigilance assistance system using NIR cameras	Computer Software
R&D VISION	France	Services	wind turbine-mounted LIDARs	Research

SEA FAST TECHNOLOGIES	France	Components	Wavefront sensor, Aberration measurement, Laser beam testing, Adaptive optics, Lens and objective quality control, Surface testing, Quantitative phase microscopy	
STEREOLABS (Research Centre, Orsay)	France	Contract research	embedded software, real time software, modelling testing, sdl sdl-rt uml asn.1 ttcn rtos	Computer Software

Annex 2: Overall list of ranked SMEs with ranking values

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Cellavision AB	Medium	22	22,93	101-	1st=	100,0%
HOLOGRAM INDUSTRIES	Medium	33	39,55	101-	1st=	100,0%
Kromek Group Plc	Medium	13	10,44	101-	1st=	100,0%
RIEGL Laser Measurement Systems Gesellschaft m.b.H.	Medium	27	31,36	101-	1st=	100,0%
SOLA-Messwerkzeuge GmbH	Medium	67	29,00	51-100	5th	97,1%
Ekspla	Medium	24	15,71	21-50	6th=	84,1%
M Squared Lasers Limited	Medium	13	unknown	21-50	6th=	84,1%
Michelson Diagnostics Ltd.	Medium	10	1,61	21-50	6th=	84,1%
M-Solv Ltd.	Medium	12	unknown	101-	6th=	84,1%
Opsis AB	Small	47	16,28	21-50	6th=	84,1%
Permanova Lasersystem AB	Medium	33	4,86	51-100	11th	81,2%
Amplitude Technologies	Small	15	19,87	11-20	12th=	79,7%
Flatfrog Laboratories AB	Medium	10	unknown	101-	12th=	79,7%
Laser Quantum Ltd.	Medium	22	16,74	11-20	12th=	79,7%

Senseair AB	Medium	23	14,26	101-	12th=	79,7%
Company	**SME status**	**Company age (years)**	**Estimated turnover, MEUR**	**Estimated number of patents or patent applications**	**Rank according to pre-defined criteria for shortlisting**	**Total score, calculated using the applied ranking method**
JEANOLOGIA	Medium	21	27,15	-	16th=	78,3%
Light Conversion	Medium	22	18,20	-	16th=	78,3%
MILTECH HELLAS S.A	Medium	19	5,43	-	16th=	78,3%
THEON SENSORS S.A.	Medium	19	26,87	-	16th=	78,3%
Yelo LTD (Yelo Test Systems)	Medium	33	0,48	-	16th=	78,3%
Jos. Schneider Optische Werke GmbH	Medium	103	87,82	101-	21st	75,4%
Heliospectra AB	-	11	unknown	21-50	22nd=	68,1%
INNOVAVENT GmbH (part of Jenoptik)	Small	13	1,89	21-50	22nd=	68,1%
LUMITECH Produktion und Entwicklung GmbH	Small	15	9,18	21-50	22nd=	68,1%
Qualisys AB	Small	16	7,15	21-50	22nd=	68,1%
Nyfors Teknologi AB	Small	29	1,03	21-50	26th	66,7%
GASPOROX AB	Micro	11	unknown	11-20	27th=	63,8%
Integrated Optics	Small	4	0,20	11-20	27th=	63,8%
Intune Networks Limited	Small	16	unknown	21-50	27th=	63,8%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Obducat AB	Medium	27	3,30	101-	27th=	63,8%
Optoskand AB	Small	15	11,89	21-50	27th=	63,8%
PiezoMotor AB	Medium	19	1,26	101-	27th=	63,8%
BCB Informática y Control	Small	20	unknown	-	33rd=	62,3%
Effilux	Small	7	1,49	-	33rd=	62,3%
ELAS	Small	6	0,54	-	33rd=	62,3%
FYLA Laser S.L. (part of EUROTREND holding)	Small	8	0,03	-	33rd=	62,3%
IRIS	Small	9	2,52	-	33rd=	62,3%
LIMAB AB	Small	57	4,52	-	33rd=	62,3%
Masimo Sweden AB	Small	16	14,56	-	33rd=	62,3%
MEON Medical Solutions GmbH & Co KG	Small	4	1,58	-	33rd=	62,3%
MONOCROM	Small	23	3,15	-	33rd=	62,3%
Nanoscribe GmbH	Small	9	3,11	-	33rd=	62,3%
OptoNova AB	Small	29	1,40	-	33rd=	62,3%
Perimed AB	Small	38	6,01	-	33rd=	62,3%
Photon Energy GmbH	Small	15	0,83	11-20	33rd=	62,3%
Stratophase LTD	Micro	17	unknown	-	33rd=	62,3%
Trilite	Small	5	0,13	11-20	33rd=	62,3%

Technologies						
Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Vision Lasertechnik für Forschung und Industrie GmbH	Micro	32	unknown	-	33rd=	62,3%
Xcam Ltd	Small	21	0,27	-	33rd=	62,3%
active photonics GmbH	Small	16	0,95	-	50th=	60,9%
confovis GmbH	Micro	7	0,59	-	50th=	60,9%
EOS Innovation	Micro	6	unknown	-	50th=	60,9%
Fibresystem AB	Micro	15	2,94	-	50th=	60,9%
LPI EUROPE	Micro	14	0,40	-	50th=	60,9%
LUZ WAVELABS SL	Micro	4	0,31	-	50th=	60,9%
Optilia Instruments AB	Micro	13	1,43	-	50th=	60,9%
RGB Lasersysteme GmbH	Micro	15	1,45	-	50th=	60,9%
SunnyBAG	Micro	6	1,19	-	50th=	60,9%
ThetaMetrisis S.A.	Micro	8	0,04	-	50th=	60,9%
Advanced Fibreoptic Engineering	Micro	11	1,59	-	60th=	58,0%
LASER COMPONENTS	Medium	27	unknown	-	60th=	58,0%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
GmbH						
LEONI Fibre Optics GmbH	Medium	24	44,85	-	60th=	58,0%
LEOSPHERE	Medium	12	24,37	-	60th=	58,0%
Lifodas	Medium	22	6,37	-	60th=	58,0%
Standa	Medium	26	7,80	-	60th=	58,0%
VistaMed Limited	Medium	19	17,01	-	60th=	58,0%
EnShape GmbH	Medium	2	1,06	-	67th=	53,6%
Quantum Light Instruments	Startup	2	0,03	-	67th=	53,6%
EVK DI Kerschhaggl GmbH	Startup	34	4,32	21-50	69th=	47,8%
Excillum AB	Small	9	1,72	21-50	69th=	47,8%
Proximion AB	Small	4	2,00	21-50	69th=	47,8%
SensL Technologies Limited	Small	12	0,49	21-50	69th=	47,8%
Sol Voltaics AB	Small	8	unknown	21-50	69th=	47,8%
Eblana Photonics Limited	Small	15	unknown	21-50	74th=	46,4%
Laser- und Medizin-Technologie GmbH Berlin	Micro	21	2,81	101-	74th=	46,4%
Luxcel Biosciences	Small	14	unknown	21-50	74th=	46,4%

Limited						
nanofluor GmbH	Micro	6	0,54	21-50	74th=	46,4%
scint-x AB	Micro	10	unknown	21-50	74th=	46,4%
InfiniLED	Micro	6	unknown	11-20	79th=	43,5%
Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Midsummer AB	Small	12	1,72	11-20	79th=	43,5%
SiTek Electro Optics AB	Small	47	1,53	11-20	79th=	43,5%
Altechna R&D	Small	9	1,08	-	82nd=	42,0%
Brolis Semiconductors	Small	5	0,25	-	82nd=	42,0%
Dyoptyka	Small	10	unknown	-	82nd=	42,0%
eagleyard Photonics GmbH	Small	14	1,20	-	82nd=	42,0%
Eksma Optics (Optolita)	Small	10	6,55	-	82nd=	42,0%
FibrePulse Limited	Small	18	unknown	-	82nd=	42,0%
GD Optical Competence GmbH	Small	24	5,90	-	82nd=	42,0%
Irnova AB	Small	9	1,88	-	82nd=	42,0%
KDPOF	Small	6	unknown	-	82nd=	42,0%
LMB Automation GmbH	Small	16	3,79	-	82nd=	42,0%
Optics Balzers Jena GmbH	Small	70	6,16	-	82nd=	42,0%
Optida	Small	19	1,39	-	82nd=	42,0%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Optoga AB	Small	12	2,80	-	82nd=	42,0%
Superlum Diodes Limited	Small	16	1,95	-	82nd=	42,0%
5microns GmbH	Small	2	0,65	-	96th=	40,6%
Brite Hellas S.A.	Micro	7	1,04	-	96th=	40,6%
Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
CA ASOCIADOS	Micro	0	0,57	-	96th=	40,6%
EcoCan	Micro	5	0,49	-	96th=	40,6%
Evana Technologies	Micro	4	0,05	-	96th=	40,6%
HEBO Spezialglas GbR	Micro	27	1,00	-	96th=	40,6%
LaserTechs e.K.	Micro	6	0,33	-	96th=	40,6%
Microliquids GmbH	Micro	13	0,80	-	96th=	40,6%
MONTFORT Laser GmbH	Micro	5	0,76	-	96th=	40,6%
NIT	Micro	11	0,43	-	96th=	40,6%
Optonas	Micro	7	0,20	-	96th=	40,6%
PROTON LASER APPLICATIONS SL	Micro	6	unknown	-	96th=	40,6%
QuantaRed Technologies	Micro	8	0,52	-	96th=	40,6%
Quantum Voltaics KG	Micro	3	unknown	-	96th=	40,6%
RADIANTIS	Micro	10	1,01	-	96th=	40,6%
RBZ Embedded	Micro	13	0,92	-	96th=	40,6%

Logics						
SEA FAST TECHNOLOGIES	Micro	8	unknown	-	96th=	40,6%
Sprana	Micro	4	0,05	-	96th=	40,6%
TecSense GmbH	Micro	4	0,27	-	96th=	40,6%
Company	**SME status**	**Company age (years)**	**Estimated turnover, MEUR**	**Estimated number of patents or patent applications**	**Rank according to pre-defined criteria for shortlisting**	**Total score, calculated using the applied ranking method**
Spectrum Technologies Plc	Micro	27	6,95	21-50	115th	39,1%
Imagine Optic	Medium	20	2,45	51-100	116th	36,2%
Alter Technology	Small	17	36,07	-	117th=	33,3%
Class 5 Photonics GmbH	Medium	2	0,27	-	117th=	33,3%
RoodMicrotec GmbH	Startup	34	10,30	-	117th=	33,3%
Seren Photonics	Medium	7	unknown	21-50	120th	29,0%
Clinical Laserthermia Systems AB	Micro	16	unknown	11-20	121st=	24,6%
Crystalsol	Micro	8	2,52	-	121st=	24,6%
Femtika	Small	4	0,05	-	121st=	24,6%
Metric Industrial AB	Small	52	unknown	-	121st=	24,6%
STEREOLABS	Medium	6	unknown	-	121st=	24,6%
Attophotonics Biosciences GmbH	Small	12	0,27	-	126th=	23,2%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Biosensia Limited	Micro	16	unknown	21-50	126th=	23,2%
Crystalline Mirrors Solutions	Small	4	unknown	-	126th=	23,2%
Fibrecore Ltd.	Micro	8	0,01	-	126th=	23,2%
HarzOptics GmbH	Micro	10	0,90	-	126th=	23,2%
LEDigma	Micro	4	0,03	-	126th=	23,2%
Rolling Optics AB	Micro	14	1,43	21-50	126th=	23,2%
Radisens Diagnostics Limited	Small	7	unknown	11-20	133rd	18,8%
Arginta (part of Arginta Group)	Small	25	5,40	-	134th=	17,4%
Bartenbach Lichtlabor GmbH	Small	39	4,35	-	134th=	17,4%
Blueacre Technology Limited	Small	11	unknown	-	134th=	17,4%
Collischon Optik Design	Small	13	unknown	-	134th=	17,4%
Fasmatech S.A.	Small	7	0,12	11-20	134th=	17,4%
Feasa Enterprises Limited	Micro	31	unknown	-	134th=	17,4%
Gounas P. - K. Enezlis O.E. cnc Solutions	Small	13	0,85	-	134th=	17,4%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
GREENFIELD TECHNOLOGY	Small	15	1,24	-	134th=	17,4%
In-Vision Digital Imaging Optics	Small	11	7,87	-	134th=	17,4%
Laser Micromachining Ltd	Small	12	0,52	-	134th=	17,4%
National Energetics Inc	Small	7	1,51	-	134th=	17,4%
Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Optocap	Small	13	0,98	-	134th=	17,4%
Optronics Technologies S.A.	Small	26	2,04	-	134th=	17,4%
PHASICS	Small	13	2,96	-	134th=	17,4%
Plasmo Industrietechnik GmbH	Small	13	3,24	-	134th=	17,4%
PRAGMADEV	Small	15	unknown	-	134th=	17,4%
PRIME Laser Technology SA	Small	8	2,79	-	134th=	17,4%
Raptor Photonics	Small	10	8,98	-	134th=	17,4%
Raymetrics S.A.	Small	14	2,07	-	134th=	17,4%
SENSOFAR	Small	15	7,34	-	134th=	17,4%
SmartOptics Sverige AB	Small	12	2,97	-	134th=	17,4%
ClearSight Innovations Limited	Small	3	unknown	-	155th=	15,9%

Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
DIOTASOFT	Micro	4	0,60	-	155th=	15,9%
ecoliGhts SOLARE BELEUCHTUNG	Micro	6	0,61	-	155th=	15,9%
ilis GmbH	Micro	18	0,52	-	155th=	15,9%
Lidaris	Micro	4	0,20	-	155th=	15,9%
Lithoz GmbH	Micro	5	0,27	-	155th=	15,9%
Neulicht lighting solutions	Micro	6	0,16	-	155th=	15,9%
Company	SME status	Company age (years)	Estimated turnover, MEUR	Estimated number of patents or patent applications	Rank according to pre-defined criteria for shortlisting	Total score, calculated using the applied ranking method
Northlab Photonics AB	Micro	8	1,71	-	155th=	15,9%
Opticon Group ABEE	Micro	8	unknown	-	155th=	15,9%
Pie Photonics Limited	Micro	4	0,49	-	155th=	15,9%
R&D VISION	Micro	14	1,23	-	155th=	15,9%
RHP - Technology GmbH & Co. KG	Micro	6	0,13	-	155th=	15,9%
Solaris Photonics	Micro	7	0,05	-	155th=	15,9%
INNOV+	Micro	2	0,20	-	168th=	8,7%
OpTek Systems LTD	Startup	1	unknown	-	168th=	8,7%
Optogama	Startup	1	0,05	-	168th=	8,7%
i-RED Infrarot Systeme GmbH	Startup	6	0,19	-	171st=	7,2%
Lamda	Micro	0	unknown	-	171st=	7,2%

Technology						
					37	

Annex 3: A list of selected SMEs to be audited

Company	Country	Staff numbers	Company website
Altechna R&D	Lithuania	16	http://www.wop.com
Amplitude Technologies	France	73	http://www.amplitude-technologies.com
BCB Informática y Control	Spain	11-50	http://www.bcb.es
Blueacre Technology Limited	Ireland	unknown	http://blueacretechnology.com/
confovis GmbH	Germany	6	http://www.confovis.com
Eblana Photonics Limited	Ireland	7	http://www.eblanaphotonics.com/
Effilux	France	6	http://www.effilux.fr/
Ekspla	Lithuania	125	http://www.ekspla.lt
ELAS	Lithuania	10	http://www.e-lasers.com
EnShape GmbH	Germany	11	http://www.enshape.de
EOS Innovation	France	unknown	http://www.eos-innovation.eu/
Fasmatech S.A.	Greece	unknown	http://fasmatech.com/
Feasa Enterprises Limited	Ireland	unknown	http://www.feasa.ie/
FYLA Laser S.L. (part of EUROTREND holding)	Spain	11-50	http://www.fyla.com
HEBO Spezialglas GbR	Germany	unknown	http://www.hebo-glass.com
InfiniLED	Ireland	unknown	http://www.infiniled.com/
Integrated Optics	Lithuania	19	http://www.ioptics.lt
IRIS	Spain	38	http://www.iris.cat
Lamda Technology	Greece	1-10	http://www.lamdatech.gr/en
Laser Quantum Ltd.	UK	97	http://www.laserquantum.com
LEOSPHERE	France	unknown	http://www.fibretech.de
Light Conversion	Lithuania	120	http://www.lightcon.com
M Squared Lasers Limited	UK	60	http://www.m2lasers.com
MEON Medical Solutions GmbH & Co KG	Austria	11-50	http://www.meon-medical.com

Company	Country	Staff numbers	Company website
MONOCROM	Spain	30	http://www.monocrom.com/
Company	**Country**	**Staff numbers**	**Company website**
M-Solv Ltd.	UK	25	http://www.m-solv.com
Nanoscribe GmbH	Germany	21	http://www.nanoscribe.de
Nyfors Teknologi AB	Sweden	6	http://www.nyfors.se
OptoNova AB	Sweden	15	http:///www.optonova.se
Optronics Technologies S.A.	Greece	18	http://www.optronics.gr
Permanova Lasersystem AB	Sweden	20	http://www.permanova.se
PHASICS	France	21	http://www.phasicscorp.com/
Photon Energy GmbH	Germany	unknown	http://www.photon-energy.de
PRIME Laser Technology SA	Greece	13	http://www.primelasertech.gr
RADIANTIS	Spain	unknown	http://www.radiantis.com
RGB Lasersysteme GmbH	Germany	unknown	http://www.rgb-laser.com
RIEGL Laser Measurement Systems Gesellschaft m.b.H.	Austria	156	http://www.riegl.com/
SOLA-Messwerkzeuge GmbH	Austria	172	http://www.sola.at/
Superlum Diodes Limited	Ireland	unknown	https://www.superlumdiodes.com/