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FOR NANOMATERIALS

Study of the EU market for nanomaterials, including substances, uses, volumes and key operators

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List of abbreviations

3D - 3-Dimensional
3R - Replace, Reduce, Refine
AI - Artificial Intelligence
ANSES - French Agency for Food, Environmental and Occupational Health & Safety
CAGR - Compound Annual Growth Rate
CAS - Chemical Abstracts Service
Cefic - European Chemical Industry Council
CEO - Chief Executive Officers
CEPE - European Council of the Paint, Printing Ink and Artists' Colours Industry
CNTs - Carbon Nanotubes
DB - Database
DL - Deep Learning
DU - Downstream Users
EC - European Commission
ECHA - European Chemicals Agency
EEA - European Economic Area countries
EFCC - European Federation for Construction Chemicals
EFSA - European Food Safety Authority
EMA - European Medicals Agency
ELS - Extensive Literature Search
EU - European Union
EUR - Euro
Eurometaux - European non-ferrous metals association
EUON - European Union Observatory for Nanomaterials
FEICA - Association of the European Adhesive & Sealant Industry
FP7 - Framework Program 7
GDPR - General Data Protection Regulation
H2020 - Horizon 2020
IT - Information Technology
IUPAC - International Union of Pure and Applied Chemistry
KNIME - Konstanz Information Miner
ML - Machine Learning
MRAM - Magnetic Random Access Memory
MRI - Magnetic resonance imaging
MS - Member States
MWCNTs - Multi-Wall Carbon Nanotubes
NIA - Nanotechnologies Industries Association
NovaM - NovaMechanics
NMs - Nanomaterials
OECD - Economic Cooperation and Development
QDs - Quantum Dots

R&D - Research & Development
REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals
SbD - Safe by Design
SDS - Safety Data Sheet
SIN - Substitute it Now
SMEs - Small and Medium Enterprises
SR - Systematic Review
SWCNTs - Single-Wall Carbon Nanotubes
UK - United Kingdom
USD - United States of America Dollar
UV - Ultra-Violet
VP - Vice President
WHO - World Health Organisation

Abstract

The subject of the current study is to provide the European Chemicals Agency (ECHA) / European Union Observatory for Nanomaterials (EUON) and its stakeholders with an up-to-date analysis of the European Union's (including the European Economic Area countries (EEA) and Switzerland) nanomaterials (NMs) market, as defined by the European Commission's Recommendation on the definition of a nanomaterial published in 2011 (2011/696/EU).

This includes information on the substances available as NMs on the EU market, the main areas of application and the market operators (producers, major traders, downstream users). Based on the identified results, a comprehensive analysis was performed regarding the available substances, their uses, and the respective industry segments. Furthermore, detailed analysis was performed regarding the market operators per country (27 EU countries, EEA, and Switzerland), the industry segment, applications, as well as a rough estimation of the available NM-containing products on the EU market.

The acquired results and analyses were then used to perform a 5-year projection (average Compound Annual Growth Rate (CAGR) per volume and value) of the EU NMs market per NM type, using 3 scenarios (basic, conservative, optimistic) and discuss the results including the gaps and uncertainties, and the market drivers and barriers to further growth.

1. Executive summary

1.1 Background

Upon the request of the European Chemicals Agency (ECHA) / European Union Observatory for Nanomaterials (EUON) NovaMechanics Ltd. has undertaken a search analysis of the European Union's (including the European Economic Area countries (EEA) and Switzerland) nanomaterials (NMs) market. The work performed is based on the NMs as defined by the European Commission's Recommendation on the definition of a nanomaterial published in 2011 (2011/696/EU).

The purpose of this report is to provide the ECHA/EUON and its stakeholders with reliable information about the substances available as NMs on the EU market, the main areas of application and the market operators (producers, major traders, downstream users). The results of this study will feed into the EUON's activities to increase transparency and understanding on how the nanomaterials market is evolving and fill data gaps on the EU market information.

1.2 Content of the study

As part of the on-going activities mandated to the EUON, the Observatory wished to conduct a study to assess the EU market for nanomaterials. The purpose of this study was:

1. Identify the substances that appear as nanomaterials on the EU market, including their chemical identity (International Union of Pure and Applied Chemistry (IUPAC) name, CAS, and EC number, as available); their volumes and uses, for all substances with volumes greater than 1 tonne/year per manufacturer/importer, i.e. substances that must be registered under REACH (https://ec.europa.eu/environment/chemicals/nanotech/reach-clp/index_en.htm). Information on uses should include sector of use, product categories, as well as whether the substance is used in industrial/professional settings, or has

consumer uses.

2. Estimate the total number of market operators in the EU that are involved in producing or importing a substance or being downstream users, including identifying them, where possible.

3. Analyse the uncertainties regarding the substances, products, and operators identified in 1-2 above.

4. Provide projections regarding the expected growth of the market over the coming 5 years.

1.3 Methodology

The report was compiled following a detailed step-by-step strategy to gather the required data and provide EUON and the EUON stakeholders with the necessary insights. To achieve this, the study was divided into 7 subtasks:

1. The inception phase/workplan: Initial screening of the publicly available data, the market drivers to be targeted for the questionnaire, face-to-face and focus groups interviews and developing a proposal for the required market segmentations to optimise and maximise all data and information, leading to firm conclusions of the study.

2. The identification of the substances being produced, imported, traded, and used in the EU, based on secondary (literature) research on publicly available information (e.g., recent previous reports, market operators' quarterly and/or yearly financial reports, company websites) and primary (surveys, interviews) research with NMs manufacturing companies/importers/traders etc.

3. Identify the EU, EEA and Swiss market operators and drivers, including NM manufacturers, importers, resellers, regulatory consultants, and downstream users.

4. Design a survey, in collaboration with ECHA/EUON to share with identified stakeholders to help verifying the data and information acquired or produced in subtasks 2 and 3 and acquire information on the EU NMs market projections.

5. Analysis of the collected data.

6. Organise focus groups and personal interviews to discuss the stakeholders' perspectives and opinions of the future of the EU, EEA, the UK and Swiss NMs market.

7. Perform a 5-year market projection using 3 scenarios: basic, conservative, and optimistic.

1.3.1 Literature search methodology

The methodology followed to perform the secondary (literature) research (see section 3.1) of publicly available data was based on standardised processes for performing a robust Systematic Review (SR) based on European Food Safety Authority (EFSA) and other EU institutions guidelines. These steps include:

1. Identify, select, and critically evaluate relevant research and data sources

2. Evaluate, critically appraise, and synthesise the current body of knowledge of NMs on the EU market.

This methodology aimed to:

1. The market study was based on sound scientific pillars to enhance the reproducibility and completeness of the study.

2. Increase the credibility and transparency of the outputs, so that they can be considered as the most relevant findings from scientific and industry literature in the field.

3. ECHA/EUON and its stakeholders are provided with timely informationon the EU NMs market.

4. the results are analysed, explored, and presented in a systematic, comprehensive, and informative way.

1.3.2 Identification of EU NM market operators

To identify the current EU NMs market operators (NM producers, traders, and downstream users), the work was divided into 4 subtasks:

1. Analyse and summarise previously carried out market research, surveys, and studies on NMs on the EU market.

2. Collection of information from industry literature (e.g., by automated collection of data from industry websites on products/substances containing nanomaterials using information technology (IT) scripts).

3. Identification of market operators.

4. Formulate a questionnaire to be used for retrieving further information regarding the EU NMs market.

The basis of the presented market research was the current EC Recommendation for a definition of NMs, which dates from 2011. This allowed to create a baseline that was used for the identification and refinement of the current EU NM landscape. This was achieved through revisiting relevant reports as well as web research in relevant databases (e.g., EUON, PubChem, ChEMBL, Google, Google Scholar, PubMed, Scopus, SciVal, the Publications Office of the EU). The quality of all the identified reports to be considered was evaluated (see section 3.2) and those meeting the required threshold were used in our analysis. Based on the current state-of-the-art, the rapidly advancing technology and diverse applications, sources prior to 2015 were considered outdated and excluded.

1.3.3 Identification of key market operators

Based on the results obtained from the literature search we were able to identify the market operators of the EU NMs market, as well as key players (e.g., regulatory consultants, end users, and associations) that may play a substantial role in the development and functioning of the market. Based on these results, we prepared a questionnaire (see section 3.2.3), which was shared with relevant stakeholders to confirm data on the identity, volumes placed on the market, and market operators of the identified NMs.

1.3.4 Survey/interviews with identified industry operators

Following collection and analysis of data from the questionnaire survey, we performed interviews (see section 3.3) with key industry and market operators aimed to confirm the data acquired from the previous tasks regarding the identity, volumes and EU NMs market operators and complement these, if possible, to provide a complete picture and industry-related projections for the EU NMs market.

1.3.5 Five-year projection of the EU NMs market

The last part of the study was to produce a 5-year market projection (see section 3.4) of the EU NMs market. This was achieved by collating and analysing the data gathered in the previous steps and applying appropriate forecasting techniques to produce robust results based on our data. Based on the data, calculations were performed for three different scenarios (conservative, basic, positive) considering industry opinions and potential market drivers and barriers.

1.4 Findings

This report presents the findings by segmenting the EU NMs market landscape into 6 segments:

- Metal oxides
- Metals
- Carbon-based NMs
- Dendrimers
- Nanoclays
- Nanocellulose

The EU NMs market (including the EEA countries and Switzerland) was estimated, for 2020, at a volume of 140,000 tonnes and a value of 5,200 € million. The market is expected in the next 5 years to grow with a CAGR of 13.9% per volume and 18.4% per value creating strong positive socioeconomic impact for the EU, EEA, and Switzerland. While currently the largest segment is the metal oxides market, growth will be mainly driven by the nanoclay, nanocellulose and carbon-based NMs.

To the best of our knowledge, a total of 1,168 NM organisations were identified in the EU, EEA, and Swiss market. Eighty-eight of those are NM producers, with 27.2% being based in Germany, followed by Spain (11%) and France (9.1%). Of the 1,054 EU, EEA and Swiss downstream users, Germany leads the market with 34.6%, followed by France (11.9%) and Sweden (7%). A rough estimate of 2,800 existing NM-containing products (excluding NMs production) indicate that Germany leads the market with 35.4%, followed by Switzerland with 20.4% and Sweden with 5.7%.

Most of organisations were identified as belonging to the fields of manufacturing, medicine and life sciences, personal care, and instrumentation and electronics. Further segmentation identified the two most dominant segments and their market shares: coatings, paints and sealants (18.8%), and instrumentation and electronics (17.8%), noting as well that the combination of the medicine and personal care segments would lead to a dominant segment of 20.3%.

A total of 92 NMs (including mixtures, doped NMs and alloys) are available on the EU, EEA, and Swiss market, which have not been listed by any of the inventories that the EUON report on. It is unclear, though, whether these substances are above the combined bulk and nano 1 tonne per year per manufacturer/importer threshold and thus whether some of these should be registered under REACH. We also need to note here that specific uncertainties exist regarding the identified substances. These include how doped NMs and alloys should be dealt with. In all cases, the potential exists of substantial changes in the NMs properties through interaction with the surrounding environment or structural disruptions at doping levels a lot higher than those of naturally occurring impurities.

The key drivers for growth, in the EU NMs market, will be:

- Technological advancement.
- Public demand for functional, lightweight, and affordable state-of-the-art products.
- Industry requirements, with aerospace, automotive, energy, food packaging, construction, and other industries driving growth.
- The use of NMs in medicine and personal care.
- Public funding on the development of novel complex and advanced NMs.
- More advanced and robust manufacturing lines and standardised manufacturing processes, which will substantially reduce the cost of NMs and producing NM-containing products.

The main barriers for growth, in the EU NMs market, will be:

- The current regulatory landscape.
- The lack of a clear and unique definition of NMs and NM-containing products throughout the EU, EEA and Swiss market (even if it is sector specific).
- The relatively negative public opinion.
- Lack of investment for scaling up production leading to reduced costs.
- Introduction of regulatory requirements for polymers, which are used in conjunction with nanoclays, may further hinder the market.

2. Introduction

The subject of this report is to provide a comprehensive insight into the substances available as nanomaterials (NMs) on the European Union (EU) market, an overview of the main areas of application and of the approximate volumes of NMs on the market. The work performed is based on the NMs as defined by the European Commission's (EC) Recommendation on the definition of a nanomaterial published in 2011 (2011/696/EU) [1].

The results presented here are based on an optimised combination of primary and secondary research, with primary research referring to direct communication with relevant stakeholders (i.e. manufacturers who either use NMs themselves in some applications, or supply it to other (end-)users in industry) in the form of questionnaires, face-to-face and online interviews and focus groups. Secondary research refers to the systematic investigation, acquisition, synthesis and analysis of publicly available data (e.g., previous studies, REACH registrations, webpages, information from national inventories, peer-reviewed publications, quarterly/yearly financial reports). The results of the primary and secondary research were structured, harmonised, and combined and analysed to provide, as far as possible, a robust and validated analysis of the current state of the EU NMs market, with a focus on filling the existing data gap concerning market information on NMs, and to provide a realistic projection of the NMs market growth for the next five (5) years. An analysis of the uncertainties regarding the substances, products and operators has also been included.

NMs have become part of everyday life as they are being used extensively in a wide range of consumer goods (e.g., personal care and cosmetics, food additives) and industrial products such as solar cells and paints. Based on previous studies [2], [3] the European NMs market was estimated to be worth around €2.1 billion in 2015 and was projected to grow with a Compound Annual Growth Rate (CAGR) of 20% for the period of 2016 - 2022 to €7.5 billion. The nanoclay market was expected to lead this growth (CAGR: 24.3%), with personal care being the fastest growing end-user segment (CAGR: 21.2%) and Germany leading the market (CAGR: 20.4%). A later study [4] projected the NMs market to register a CAGR of 15.24% in terms of revenue during the 2020-2028 period.

This means that the NMs market has substantially expanded over the years, boosted by the advancing technology, public funding through the Framework Program 7 (FP7) and Horizon 2020 (H2020) and the advancement of nanoinformatics techniques that can assist with decoding the NMs behaviour and help design safer NMs with unique properties. Furthermore, the current report presents a study of the potential impacts, if any, from the SARS-COV-2 pandemic and Brexit, noting that a further boost is expected with the emergence of novel nanoscale complex and advanced materials.

3. Methodology

The main objective of this study was to provide the ECHA/EUON stakeholders with insight into the substances available as nanomaterials on the EU market, an overview of the main areas of application and of the approximate volumes of nanomaterials on the market. To successfully achieve the required task, the objective was divided into targeted subtasks that formed the project's pillars. The project subtasks included:

1. The inception phase/workplan: The first subtask included an initial screening of the publicly available data, the market drivers to be targeted for the questionnaire, face-to-face and focus groups interviews and a proposal on the required market segmentations to optimise and maximise all data, information, and conclusions delivery.

2. The identification of the substances being produced, imported, traded, and used in the EU, based on secondary research into publicly available information (e.g., recent previous reports, market operators' quarterly and/or yearly financial reports, company websites) and primary research with NMs manufacturing companies/importers/traders, NM-related associations (e.g., Eurometaux (European non-ferrous metals association), Cefic (European Chemical Industry Council), Eurocolor, FEICA (Association of the European Adhesive & Sealant Industry), CEPE (European Council of the Paint, Printing Ink and Artists' Colours Industry), EFCC (European Federation for Construction Chemicals), Nanotechnologies Industries Association (NIA), BioNanoNet), small and medium enterprises (SMEs), regulatory consultancies and academia. Information on uses includes sector of use, product categories, as well as whether the substance has uses, which result in industrial/professional setting, or consumer uses.

3. Identify the market operators and drivers, including NM manufacturers, importers, resellers, regulatory consultants, and downstream users. Research covered as many EU-27 countries as possible, EEA associated countries, Switzerland, and the UK.

4. Based on the results of subtasks 2 and 3, a survey was designed and refined in collaboration with ECHA that was shared with identified stakeholders and helped verifying the data and information acquired or produced in subtasks 2 and 3 and acquiring information on the EU NMs market (see section 4 for definition of this term) projections. Where possible, face-to-face interviews were performed to acquire more detailed information. All actions were performed in accordance with the General Data Protection

Regulation (GDPR) regulation (https://gdpr.eu/what-is-gdpr). No confidential data have been included or shared in this report.

5. The analysis of the collected data, including related uncertainties, was based on the methodologies proposed in ECHA's "Critical review of the relevance and reliability of data sources, methods, parameters and determining factors to produce market studies on manufactured nanomaterials on the EU market" [5].

6. Based on all acquired data and conclusions reached, focus groups and personal interviews were organised to discuss the stakeholders' perspectives and opinions of the future of the EU, EEA, the UK and Swiss NMs market.

7. Three scenarios were produced with respect to the market analysis: basic, conservative, and optimistic.

3.1 Extensive Literature Search (ELS) and alignment to Systematic Review (SR) methodology

The methodology followed to perform the secondary research for the market study was based on the standardised processes for performing a robust Systematic Review (SR) in combination with an Extensive Literature Search (ELS) protocol, as endorsed by the European Food Safety Authority (EFSA) and other EU institutions [6]. This covers all steps including identifying, selecting, and critically appraising relevant research and data sources, appraising and synthesising the current body of knowledge on NMs on the EU market. Structuring the methodology based on the principles of SR and ELS, ensured that: i) the market study was based on sound scientific pillars, which enhanced the reproducibility of the study, ii) the protocol increased the credibility and transparency of the outputs of the ELS, so that they can be considered as the most relevant findings from scientific and industry literature in the field, iii) EUON/ECHA have access to timely information on the state-of-the-art, and iv) identified results were analysed, explored and presented in a systematic, comprehensive and informative way, which is useful and interpretable by ECHA/EUON and other stakeholders.

A draft protocol was developed for conducting the ELS as a SR, by defining in advance the review questions and scope, the methods of the SR, and the eligibility criteria for the inclusion of studies/reports and materials into the market study. This helped to reduce bias as the process was clearly specified in advance, and the reviewers strictly followed the documented process. In addition, the extensiveness and reproducibility of the search strategy and the transparent reporting of how studies were selected and included in the study reduced bias in the selection of research studies. The search strategy is reported to allow the readers to judge how much of the relevant literature is likely to have been identified.

The ELS includes the assessment of the quality of the evidence in terms of study methodological soundness, gives an indication of the strength of evidence provided by the review and allows to emphasise the results from studies/sources of higher quality. The methodology of the review process is documented to allow others to critically appraise the judgments made in study selection and the collection, analysis, and interpretation of the results.

Overall, the ELS follows closely the fundamental principles of systematic reviews, i.e., i) methodological rigour and coherence in the retrieval and selection of studies/sources, assessment of their methodological quality, and the synthesis and interpretation of information, ii) transparency, and iii) reproducibility, while the characteristics have been adjusted to comply with SR characteristics where necessary, as shown in Table 1.

TABLE 1: CHARACTERISTICS AND DESCRIPTION OF ALIGNED ELS AND SR		
#	**Characteristics**	**Description**
1	Study questions	Focused and explicit
2	Eligibility criteria for inclusion or exclusion of studies	Pre-defined and documented; objectively applied
3	Description of the review method	Reported and predefined in a protocol
4	Literature search	Structured to identify as many relevant studies as possible
5	Methodological quality assessment of included studies	Included, typically using a quality assessment tool
6	Reporting of study results	Full reporting of relevant results (numerical results)
7	Synthesis	Quantitative synthesis (meta-analysis) when possible

3.1.1 General method for a systematic review

The core steps of a systematic review are illustrated in Figure 1. Each step must be carefully documented in the SR to ensure transparency and reproducibility. More detailed information on the draft protocol is presented within the descriptions of the individual subtasks, where specific steps and their content in relation to the ELS/SR are also defined. Based on the sources identified we followed the selected methodology to analyse the results acquired and identify key stakeholders.

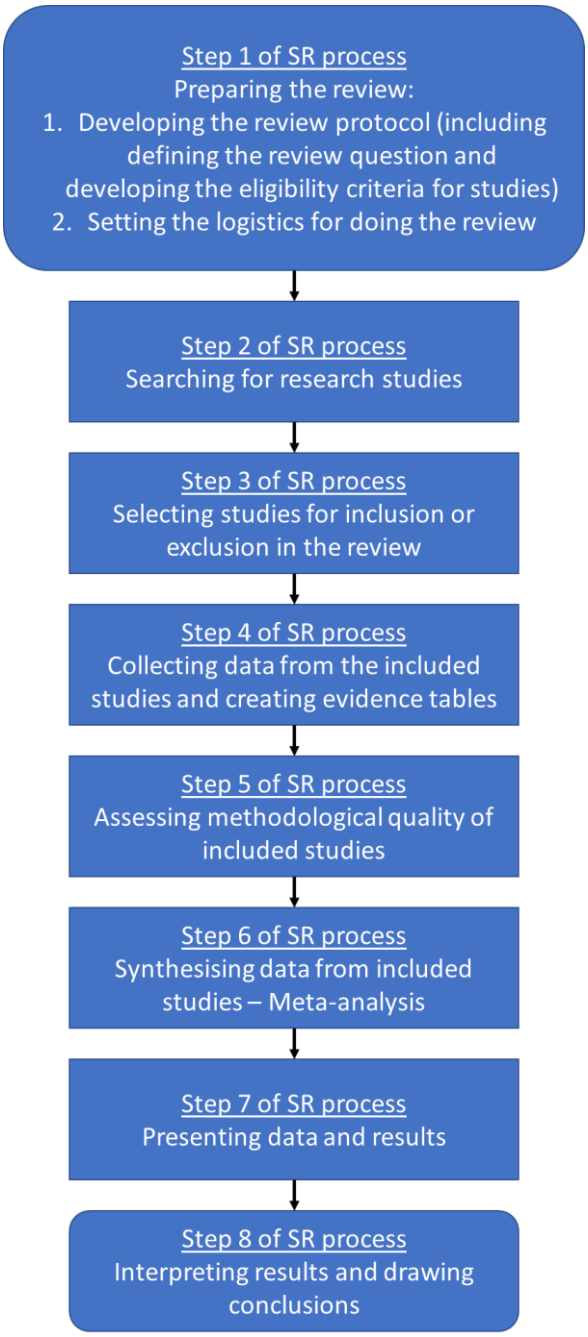

Figure 1. Cores steps for performing a systematic review (as adapted by [6]), from the Cochrane Handbook for Systematic Reviews of Interventions [7].

3.2 Identification of EU NMs market operators

The objective of this subtask was the collection and analysis of previously carried out research and a proposal for a survey to identify the substances available as NMs on the EU market and the key operators. The work performed was based on the following steps related to the ELS/SR for each field of information:

- Selection of databases to be examined (step 2 of SR)
- Criteria to select the studies/reports (step 3 of SR)

- Criteria for data extraction (step 4 of SR)
- Assessment of the quality of the data (step 5 of SR)

To achieve the required tasks the work was divided into 4 subtasks:

- Analyse and summarise previously carried out, reliable (e.g., authority, academia, market operators) market research, surveys, and studies on the nanomaterials EU market.
- Collection of information from industry literature (e.g., by automated collection of data from industry websites on products/substances containing nanomaterials using IT scripts).
- Identification of market operators.
- Formulate a questionnaire to be used for retrieving further information regarding the EU NMs market.

3.2.1 Analysis of previous reports on the NMs on the EU market

The identification and analysis of previously carried out, reliable market research, surveys, and studies of the NMs on the EU market, allowed us to create a baseline that was used for the identification and refinement of the current EU NM landscape. This was achieved through revisiting the reports identified in the previous landscape analysis [8], where we checked if recent updates exist, and web research in relevant databases (e.g., EUON, PubChem, ChEMBL, Google, Google Scholar, PubMed, Scopus, SciVal, the Publications Office of the EU). For any of the identified reports to be considered, they needed to meet an initial set of criteria. These include:

- The definition of NMS from Commission Recommendation 2011/696/EU [1] was taken as the baseline and starting point for the study.
- Based on the current state-of-the-art, the rapidly advancing technology and diverse applications, sources prior to 2015 were considered outdated and excluded.

A first screening includes reports and peer-reviewed publications from: Allied market research [3], Mordor Intelligence [9], Future Market insights [10], Global Market Insights [11], Inkwood Research [4], QYResearch (including nanomedicine) [12], The Publications Office of the EU [8], Siddique and Numan [13], Fytianos et al. [14].

In close collaboration with ECHA we defined the guidelines regarding the relevance of the identified sources that were used to create a dataset with all required extracted information that was subsequently fed into the questionnaire preparation for the key stakeholders' interviews and the 5-year market projection. The baseline for these guidelines were those used in the previous relevant report [8] to ensure data continuation, harmonisation, and interoperability. For a resource to be considered as usable, the following set of qualitative criteria were considered:

- Does the data source provide market data for a defined specific baseline year? This criterion was answered as yes or no. In case of yes, it was specified how differentiated is the market data (e.g., countries, regions, types of nanomaterials, etc.);
- Does the data source provide market forecasts into the future? This criterion was answered as yes or no. In case of yes, it was specified how differentiated is the market data (e.g., countries, regions, types of nanomaterials, etc.);

- Criteria for relevance and reliability of study methods and additional general assessment criteria. This criterion focuses on the study methods applied, including the type of source (primary, secondary, etc.). In addition, it addresses the independence/neutrality, credibility or tendentiousness of the study and source itself (author or editor) in general;

- Specific assessment criteria applicable for certain types of studies only. This criterion addresses if there is any specific data or questions addressed in the study (e.g., it provides additional specific data input to other studies). Thus, the criterion was answered as yes/no and if yes, specify;

- Does this study in particular address the different roles and importance of EU Member States (MS) for the nanomaterials market? This criterion addresses if there are any specific issues on MS (e.g., availability of country-specific information). Thus, the criterion was answered as yes/no and if yes, specify;

- Do the latest reports consider the ongoing SARS-COV-2 pandemic and its effect on the EU and world economy?

The resources that were considered relevant and significant, based on the evaluation above, were used for further market research analysis. The data from these studies were extracted and curated in a dataset and processed to reach initial conclusions regarding the EU market, including existing informational gaps that were fed into the preparation of the questionnaire survey, personal interviews and focus groups. Various data segmentation approaches were used like:

a. Material type and produced volumes per type: carbon-based, metal oxides, metals, dendrimers, nanoclays, nanocellulose, nanomedicine, other NMs (e.g., complex NMs, organometallics).

b. Geography: EU total, member states, associated countries, third countries.

c. Market segment: paints and coatings, adhesive and sealants, healthcare and life sciences, energy, electronics and consumer goods, personal care, aerospace, other end users (e.g., research).

d. Main market drivers: manufacturers, importers, exporters, resellers. Further analysis included screening of FP7 and H2020 nano-related project consortia to identify potential providers and/or traders.

3.2.2 Collection of information from industry literature on products/substances containing NMs

For the identification of industry literature sources, we used the results from the previous task to identify and retrieve information on the NM substances that are available on the EU market. To retrieve the necessary data, we used a combination of manual and javascript/java or python-based data gathering scripts and workflows developed by NovaMechanics within KNIME (Konstanz Information Miner) Analytics Platform [15] with the aid of Enalos+ nodes (developed by NovaM) [16]. NovaM has developed a variety of workflows such as web crawlers (Figure 2) dedicated to web content extraction and data reorganisation which renders it suitable for further analysis. The download of website content and the steps for data extraction and reorganisation are supported by KNIME XML node collection. The extraction of knowledge from web sources is a complex task and involves many different steps in a wider variety of disciplines. NovaM has the expertise as well as the specialised tools to carry out all the tasks required for the knowledge extraction from the web, web crawling, database storage, the text analytics, sentiment analysis, user network representation, statistics, web analytics.

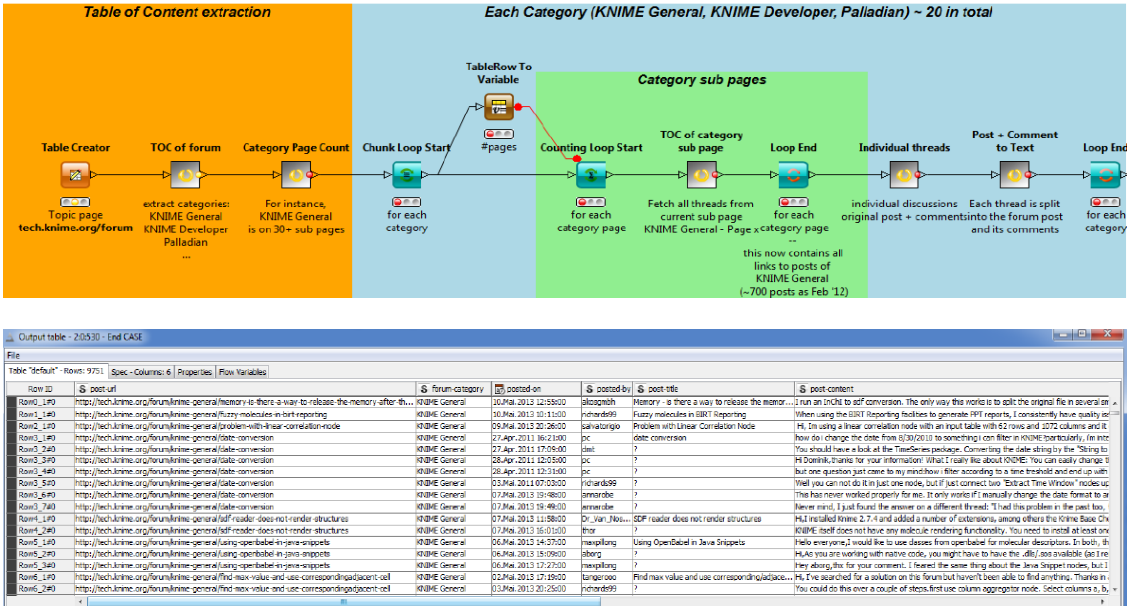

Figure 2. Representative WebCrawler workflow and table with post data after crawling analysis in KNIME.

The sources that were used were EU data sources (e.g., ECHA registered substances database), MS data sources (e.g., French and Belgian NM inventories, national chemical and environmental agencies, MS regulatory bodies), commercial market information (e.g., product catalogues, annual and financial reports, commercial reports), research data sources (e.g., peer-reviewed publications, public project deliverables), databases (e.g., Nanowerk database) and other data sources (e.g., nano-related projects websites, online articles, the Organisation for Economic Cooperation and Development (OECD) and World Health Organisation (WHO) data sources). Further analyses included the screening, where possible, of the safety data sheet (SDS) of the identified NMs to extract further information. The results were enriched with information on the IUPAC name, CAS and EC number, as available, and when not readily available attempts were made to acquire the information directly from the providers or traders.

An initial list of identified providers/traders included, but was not limited to: Merck KGaA (Germany, for Sigma Aldrich), Thermo Fisher Scientific (USA), Covestro AG (Germany), Arkema (France), NanoCYL SA (Belgium), Evonik (Germany), BASF (Germany), NanoBioMatters (Spain), Nanogap (Spain), MBN Nanomaterialia S.p.A. (Italy), Advanced Materials - JTJ s.r.o. (Czech Republic), Thermo Fisher Scientific (USA), Showa Denko K.K. (Japan), Daikin (Japan), DuPont (USA), Nanoco Technologies Ltd (UK), Raymor Industries (Canada), Nanophase Technologies Corporation (USA), Nanosys (USA), AMAG Pharmaceuticals (USA).

3.2.3 Identification of key market operators and preparation of research questionnaire, personal interviews, focus groups and public surveys

Based on the combination of the results from the previous tasks we identified the key operators on the EU NMs market, as well as key players (e.g., regulatory consultants, end users, associations) that may play a substantial role in the development and functionning of the market. Based on these results, we prepared a questionnaire that was shared with relevant stakeholders to confirm data on the identity, volumes placed on the market, and market operators for the identified NMs and to complement these by collecting additional information.

As envisaged, the questionnaire (see the Annex for the full questionnaire) focussed on studying the EU NMs market, market size, distribution chain, imports/exports, target group, market projection and more. The time needed to respond to the questionnaire was designed to not exceed 30 minutes in total and was divided into sections focussing on one topic at a time. Participants were able to skip parts irrelevant to them. In every case, the survey was performed as per the GDPR requirements and answered questionnaires, and any information flagged as confidential has been omitted from this report.

In general, the questionnaire was aimed at main market operators that included experts from:

- Industry (Chief Executive Officers (CEOs), Vice Presidents (VPs), marketing/product managers, market intelligence managers and sales managers)
- Industry associations (e.g., Eurometaux, Cefic, Eurocolor, NIA, BioNanoNet)
- Top-level dealers and distributors
- Government and officials at EU level (e.g., MS regulators, EUON)
- Financial bodies
- Regulatory consultants (e.g., BlueFrog Scientific)

The questions asked include the following questions:

- What are the types of products you are producing/trading?
- What are the volumes of products you are producing/trading?
- Do you import/export NMs or NMs-containing products?
- Have you registered your materials/products with REACH?
- If not, are you in the process of registering your materials/products?
- Can you describe your distribution chain?
- Which traders/importers/exporters do you collaborate with?
- Who are your main competitors with respect to NMs?
- How do you think the NMs market will look in the next 5 years?
- What do you think is the public perception regarding NMs and NMs-containing products?
- What are the barriers regarding the expansions of the NMs market?
- How do you think the current regulatory framework affects/will affect the EU NMs market?

3.3 Survey/interviews with identified industry operators

The interviews with key industry and market operators aimed to confirm the data acquired from the previous tasks regarding the identity, volumes and EU NMs market operators and, if possible, complement these to provide a complete picture for the EU NMs market. The survey addressed key industry associations (e.g., Eurocolor, NIA) and their member companies, as well as

representatives of SMEs and downstream users (DU).

The interview activities included the following steps related to the ELS/SR protocol for each field of information:

- Selection of stakeholders to be contacted (step 2 of SR).
- Criteria to select the studies/reports (step 3 of SR)
- Criteria for data extraction (step 4 of SR)
- Assessment of the quality of the data (step 5 of SR)

A comprehensive database of stakeholders, including all relevant information was created and shared with ECHA. The database was updated based on new data, for ensuring there are sufficient resources for the distribution of the questionnaires and under the legal framework of GDPR. The stakeholder pool, as stated earlier, consisted of:

- Industry (CEOs, VPs, marketing/product managers, market intelligence managers, national sales managers including from SMEs)
- Industry associations (e.g., Eurometaux, Cefic, Eurocolor, NIA, BioNanoNet, FEICA, CEPE, EFCC)
- Top-level dealers and distributors
- Government and officials at EU level (e.g., MS regulators, EUON)
- Financial bodies
- Regulatory consultants (e.g., BlueFrog Scientific)
- Consumer groups

The questionnaire that is presented in the Annex was used to identify:

- Complementary information on the market research and literature research on identity, volumes, and market operators of nanomaterials
- Additional information on these points (identity, volumes, and market operators for nanomaterials on the EU market) from industry, to provide a complete picture of the EU market.

3.3.1 Organisation, preparation, distribution of the questionnaires and collection of the data

The questionnaire was distributed to the target audience, as identified in the stakeholder database. A protocol was set up, in collaboration with ECHA, on the procedures for contacting stakeholders, to ensure an effective collaboration and the maximisation of the impact of the surveys/interviews. The process followed included:

- Set clear, attainable survey goals that will be identified from the data gathered.
- Include analytical questions that are customised for different market operators and to the purpose of their data.

- Pick the best questions that will lead to data retrieval maximisation at the optimum time frame (maximum 30 minutes for online questionnaires, and preferably no more than 15 minutes).

- Craft questions to maximise the acquired results, with an optimal ratio of closed (e.g., yes/no, multiple choice, agreement/disagreement) to open-ended (e.g., free-text, critical, personal opinions) questions.

- Ordering the questions so that the most significant questions are answered first, as there's a chance that people start, but do not finish the questionnaire.

Great care was taken to ensure that the questions were as short and straightforward as possible. Similarly, the questions were constantly being reviewed to ensure that no bias was introduced that could influence the respondents' answers. An example of a biased and unbiased version of a question is:

- Biased: Do you think that the current REACH regulation creates substantial barriers for the EU NMs market growth?

- Unbiased: What are the barriers, in your opinion, for the EU NMs market growth?

In all cases, participants were clearly informed regarding the scope and desired outcomes of the questionnaire, ensuring anonymity of responses and the handling of confidential information. These included:

- All personal data would be shared with ECHA in confidentiality and all published responses were anonymised removing any personal or commercial data.

- There was the provision for questions to be flagged as confidential. In this case, the responses and data were separated from the non-confidential data and shared with ECHA but would be in no way published. They would be used for drawing conclusions and in numerical or statistical analysis.

Based on current market research best practices [17], the questionnaire duration was designed not to exceed 30 minutes (in the case where substantial free text was imported), with an average duration of around 15 minutes. The questionnaire was divided into sections, with each section addressing a single topic to keep the respondent focussed at all times. Where possible, questions did not require free text import to reduce the time and effort needed from the participants. In such cases, questions included multiple choice answers, agreement/ disagreement degree etc. As a baseline the following sections were included: Personal information; Market size; NMs production and volumes; Supply chain; End-users; Future projection; Uncertainty status, prediction, and response (i.e., how uncertain the stakeholders think the market is, if there are events that are predicted to affect the market and how prepared are the stakeholders to address sudden events).

The online survey was created via online forms, using the NovaMechanics website, and all results were automatically collected and analysed. When relevant, remote interviews with specific target stakeholders, as well as group sessions were organised, as more detailed interviews allowed us to retrieve and validate information on the NMs produced/imported in the EU and exported by the EU market, on the supply chain and on end users.

With respect to future market projection, group sessions and personal interviews with key stakeholders, from as many segments as possible, were organised. In the case of focus groups, the maximum number of participants did not exceed 8-10. During the focus groups and interviews two methods were separately employed. An open-ended discussion where stakeholders openly express their opinions and separate sessions using the Delphi method. In

this, a set of questions was provided to the participants. The answers gathered were anonymised and summarised, including the reasons behind the experts' judgments, respecting GDPR. The participants were given time to revise their answers based on the exchanged information and opinions and their answers were re-evaluated to track any changes in opinion.

The answers were then analysed to reach conclusions regarding the stakeholders' forecasting for the EU NMs market and the identification of 3 scenarios: basic, conservative, optimistic. The basic scenario is the average scenario based on publicly available and retrieved data (e.g., market volume and value, economy growth rate) during this project, without assuming any substantial negative or positive effects. The conservative scenario takes into account serious and severe outcomes that may take place and can affect the market. These, for example, include a resurgence of the pandemic, trade issues due to unforessed circumstances (e.g., BREXIT related), and increased regulatory difficulties. The optimistic scenario is a scenario based on ideal circumstances and without any adverse or severe events.

3.4 Five-year projection of the EU NMs market

To produce the 5-year market projections regarding the EU's NMs market, the following step related to the ELS/SR protocol for each field of information was performed:

- Data interpretation (step 8 of SR)

The starting point for the market projections was all the data collected during the project and analysed using appropriate forecasting techniques. Currently, there are 3 types of forecasting techniques:

- Qualitative: These techniques use qualitative data (e.g., expert opinions) and information about special events and may not take the past into account.
- Time series and projections: These techniques focus on patterns and pattern changes, and thus rely entirely on historical data.
- Causal models: These techniques use highly refined and specific information about relationships between system elements and is powerful enough to take special events formally into account. As with time series analysis and projection techniques, the past is important to causal models.

Within each category there are different approaches that can be employed. Here, we used the methods that fit our data best, have acceptable predictivity and can be run and produce results and conclusions within the short project timeframe. The best candidates from each category were:

- Qualitative: Delphi method (2-years and up accuracy: fair to very good) and market research (2-years and up accuracy: fair to good).
- Time series and projections: trend projections (2-years and up accuracy: good).
- Causal models: econometric model (2-years and up accuracy: good), economic input-output model (2-years and up accuracy: good to excellent).

Based on the data retrieved calculations were performed for the different scenarios (conservative, basic, positive), using the Enalos nodes, along with the annual and average CAGR for the 5-year period and are presented below.

4. Results

4.1 Identification of EU NMs market operators

With the term 'EU NMs market', we define the area (Figure 3) which includes the 27 EU countries (i.e., Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden), the EEA (i.e., Iceland, Liechtenstein, Norway) and Switzerland. For the purposes of this research, and because it covers data from years prior to BREXIT (31 December 2020), the United Kingdom (UK) is also considered, but in the later stages of this report (e.g., identified substances, market projections) the UK market is not included.

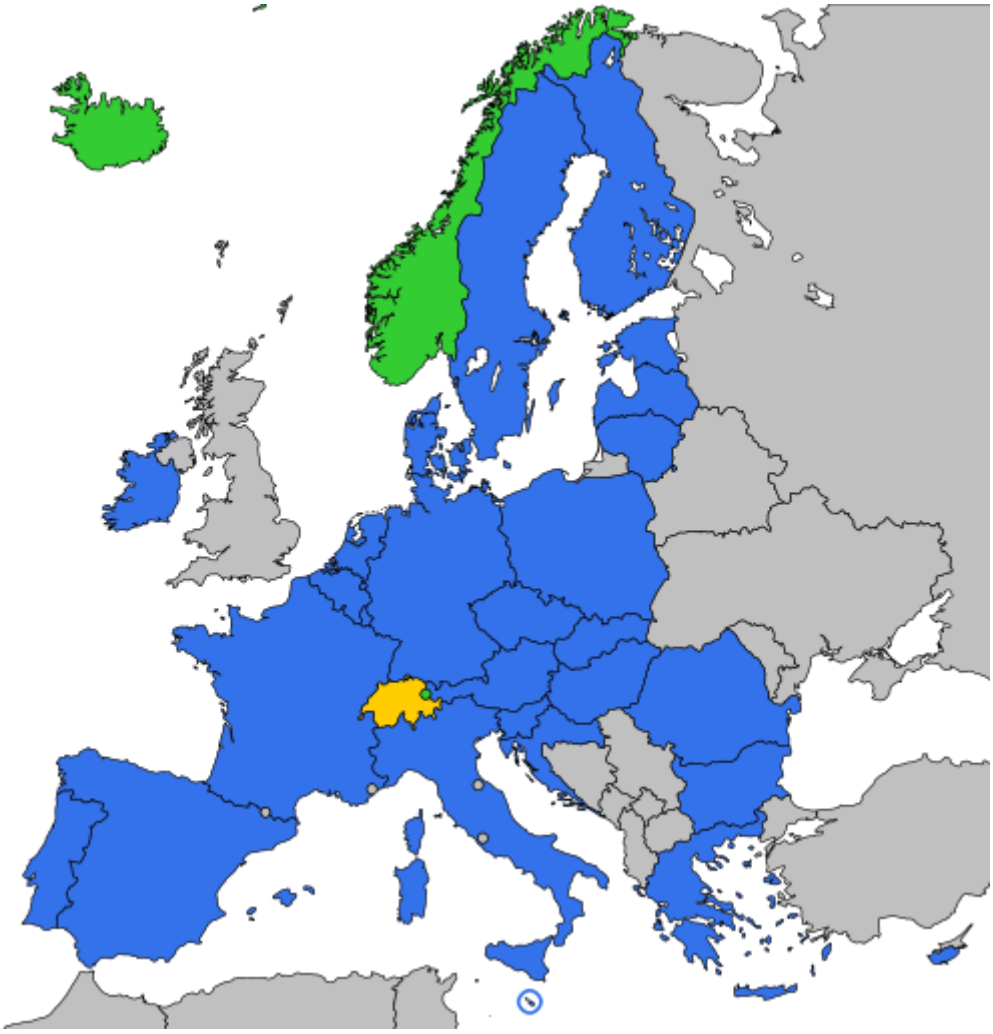

Figure 3. The EU NMs market area includes the 27 EU countries, the EEA and Switzerland. EU countries: blue, EEA countries: green, Switzerland: yellow.

Our research started from well-known NMs providers, who provide services to Europe as well. These include BASF (Germany), Covestro AG (Germany), Evonik (Germany), Merck KGaA (Germany, for Sigma Aldrich), NanoCYL SA (Belgium), Solvay S.A. (Belgium), and Thermo Fisher

Scientific (USA). To examine and map the EU NMs market land scape, we then researched nano-related databases (DBs) like the EUON database (https://euon.echa.europa.eu/search-for-nanomaterials), NanoWerk (https://www.nanowerk.com/), the Nanodatabase (https://nanodb.dk/) and the Nanotechnology Products Database (https://product.statnano.com/). Further sources included reports from Allied market research [3], Mordor Intelligence [9], Future Market insights [10], Global Market Insights [11], Inkwood Research [4], QYResearch (including nanomedicine) [12], The Publications Office of the EU [8], Siddique and Numan [13], Fytianos et al. [14].

The acquired results map the entire NMs market, which besides producers and product manufacturers (e.g., products including NMs, lithography, instrumentation) includes sectors offering NM-related services like software development, financing, and consulting. An analysis per country of the data regarding the identified NM stakeholders is presented in the Annex (Tables A1, A2, and A3). The UK, as a third country, is presented at the end of each table and graphs. The data is presented per market type (NM producers, Downstream Users, Software & Consulting), with the Downstream Users further segmented per industry and use. These include:

- Aerospace
- Agriculture
- Automotive
- Clothing
- Construction
- Food & Feed
- Home Care
- Manufacturing
- Medicine & Life Sciences
- Personal Care
- Personal Equipment
- Petroleum
- Sport & Fitness

The subcategories were defined to match specific uses and the potential of exposure of the public to NMs. For example, Clothing & Personal Equipment refers to anything that may come in contact with humans (e.g., clothes, shoes, helmets) and has the potential to release NMs. The subcategories used for analysis include:

- Aerospace & Automotive
- Chemicals & Polymers
- Clothing & Personal Equipment
- Coatings, Paints, Sealants

- Construction Materials
- Cosmetics & Personal Care
- Energy
- Food & Feed (including packaging)
- Home appliances
- Home, Garden, Environment (indoors, outdoors materials, water filters etc.)
- Instrumentation & Electronics
- Lithography & Printing
- Medicine
- Sport & Fitness
- Textiles
- Toys

The EU NM-market is highly active and expanding, having presence in nearly all the EU and EEA countries and Switzerland. Of the 33 countries studied, only Croatia, Iceland and Malta do not have, to the best of our knowledge, NM-related companies. In total, 1,396 NM-related organisations were identified. Of the total number of organisations (Figure 4) identified, 83.7% (n = 1,168) are EU-based (including EEA countries and Switzerland) and 16.3% (n = 227) are based in the UK.

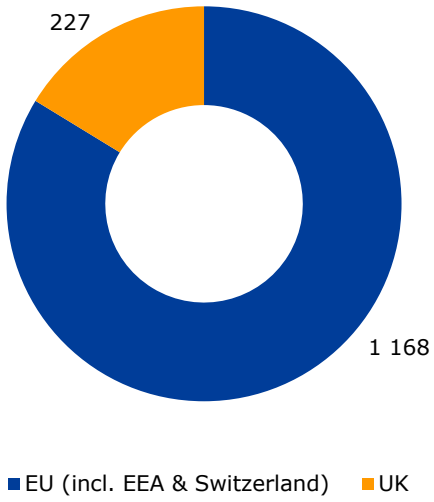

Figure 4. Out of the 1,396 NMs-related organisations 1,168 (83.7%) are based in the EU, EEA, and Switzerland and 227 (16.3%) in the UK.

A total of 120 NM producers (Figure 5, see Annex, Table A1) have been identified through online search and relevant databases (e.g., NanoWerk, NanoDatabase). The highest number of producers are based in the UK (n = 32, 26.7%), followed by Germany (n = 24, 20%). In the EU, Germany leads the NMs production with a market share of 27.2%, followed by Spain (n = 10, 11.4%) and France (n = 8, 9.1%). Besides the major market players, for example Sigma-Aldrich, Fisher Scientific, OCSiAl, Solvay, BASF, most of the companies are start-ups or SMEs. The majority of the NM producers deal with carbon-based NMs, e.g., graphene, carbon nanotubes (CNTs), followed by metallic (metals, metals oxides) and then organic NMs.

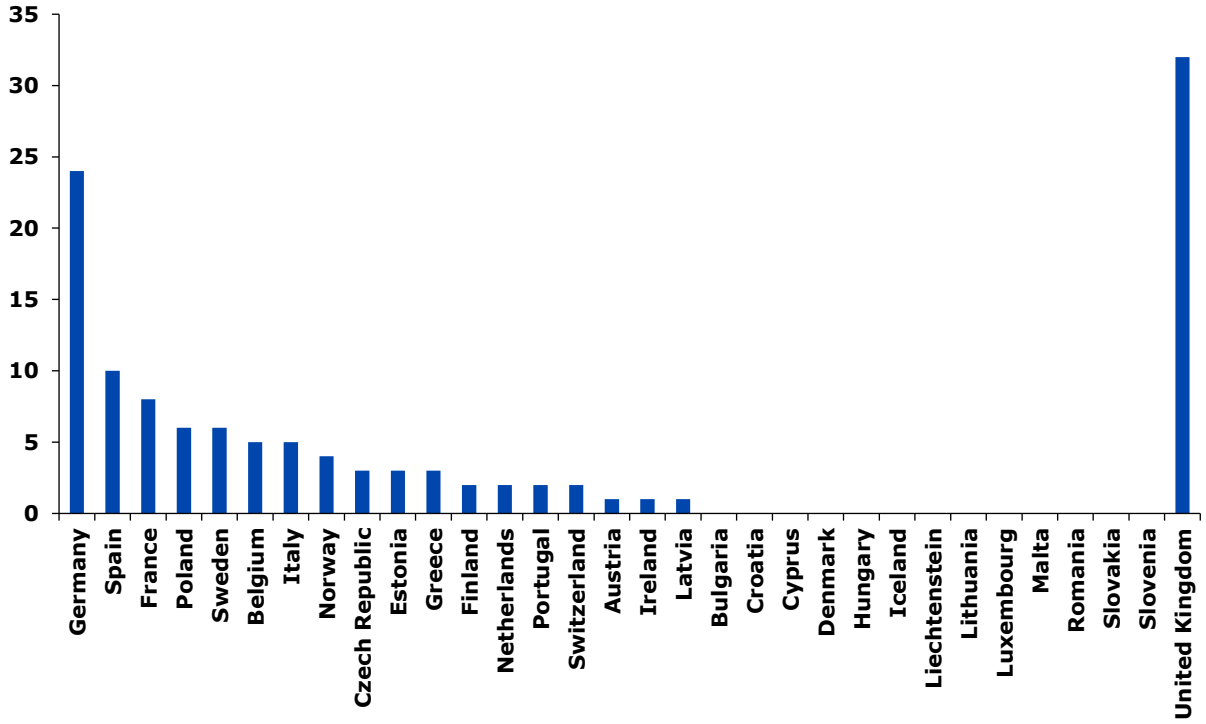

Figure 5. Out of the 120 NMs producers, 73.3% are based in the EU and 26.7% are based in the UK market. Germany leads the EU market with a market share of 27.2% (out of 88 EU NMs producers), followed by Spain (8.3%) and France (6.7%).

A geographical analysis of the European NMs market by Inkwood research (Figures 6, 7) [4] demonstrated that, since 2016, Germany has been leading the market with a market worth of around 1.6 billion Euros (38 kilotons production), followed by France (1 billion Euros, 23 kilotons) and Italy (700 million Euros, 14 kilotons). These are followed by Poland (200 million Euros, 4 kilotons) and Belgium (65 million Euros, 1 kiloton), while the rest of Europe is valued around 1.7 billion Euros (42 kilotons). The UK had a NMs market of 650 million Euros in 2020 (15 kilotons).

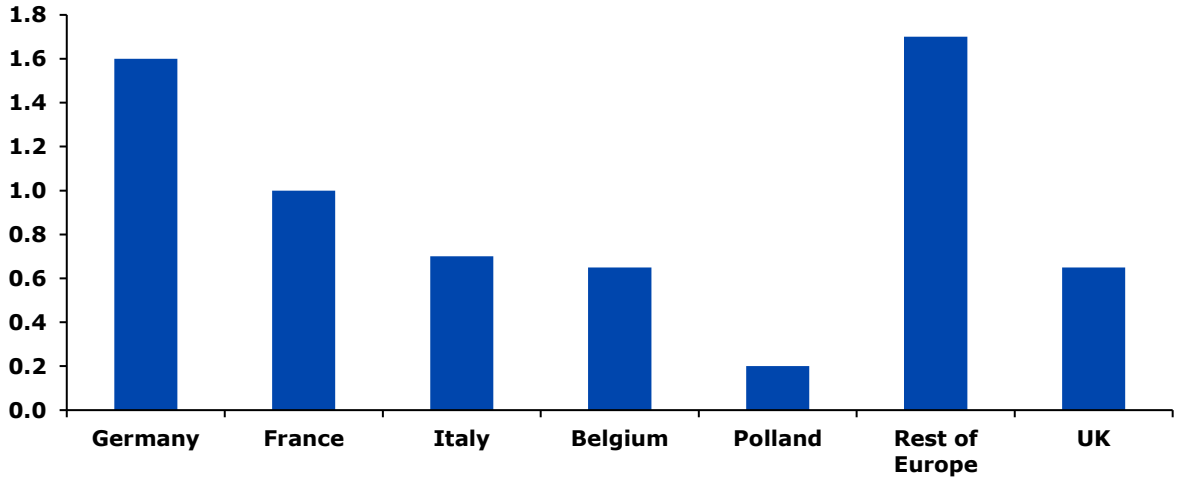

Figure 6. EU, EEA, and Switzerland average market worth, since 2016, in billions of Euros per country. UK, as a now third country, is included for comparison and historical purposes. Data from [4].

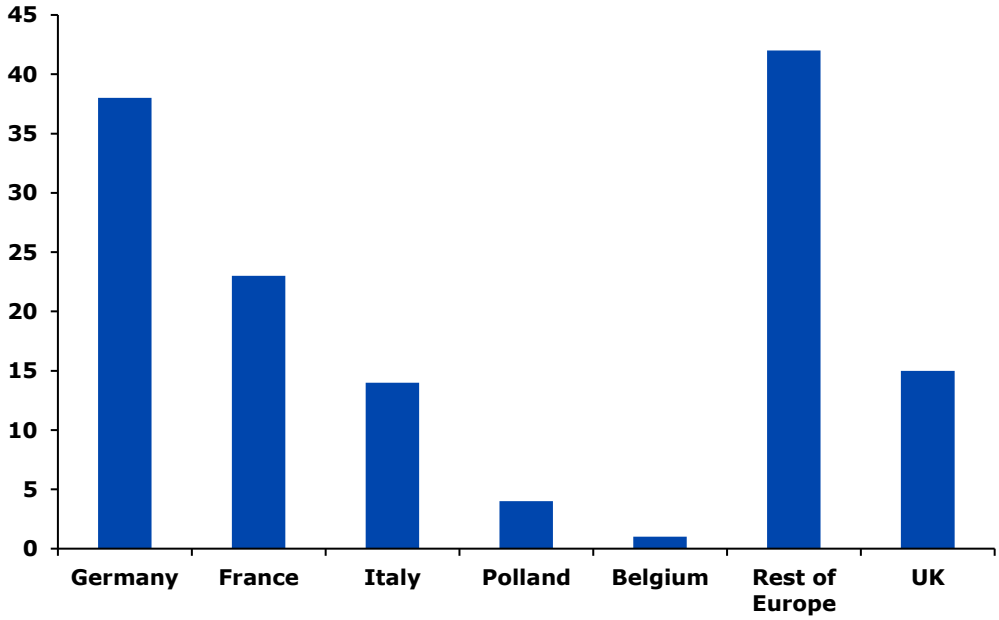

Figure 7. EU, EEA, and Switzerland market average NMs production volumes in Kilotons per country. UK, as a now third country, is included for comparison and historical purposes. Data from [4].

The downstream industrial users (Figure 8), in the combined EU and UK markets are estimated to be around 1,240 (Figure 6, Table A2 of the Annex). The number of users can increase substantially when considering academia and the different researchers dealing with NMs and taking part in NMs research, although the volume used in these cases is not high. According to the Nanowerk database (https://www.nanowerk.com/nanotechnology/research/nanotechnology_links.php) use by academia and in research can involve more than 1,300 organisations (considering governmental and private laboratories as well) raising the number of downstream users to more than 2,500. Figure 8 presenets the distribution of the downstream users between the EU and UK markets, with the EU having a market share of 85% (n = 1,054).

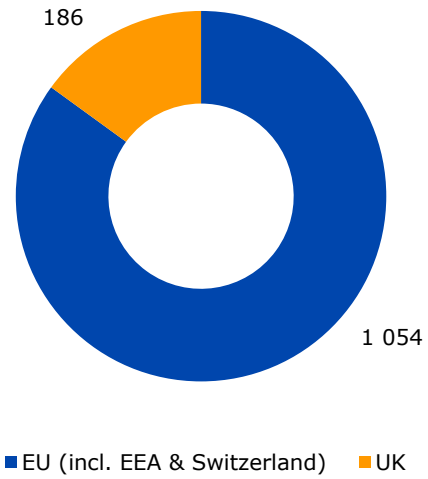

Figure 8. In the industrial NMs downstream users (n = 1,240), the EU has a market share of 85%.

A per country analysis (Figure 9) showed that German companies (n = 429) have a market share of 41% of the total (n = 1,054) and is followed by Sweden (n = 87) and France (n = 83) with 8.3% and 7.9% of the total, respectively, see Figure 7.

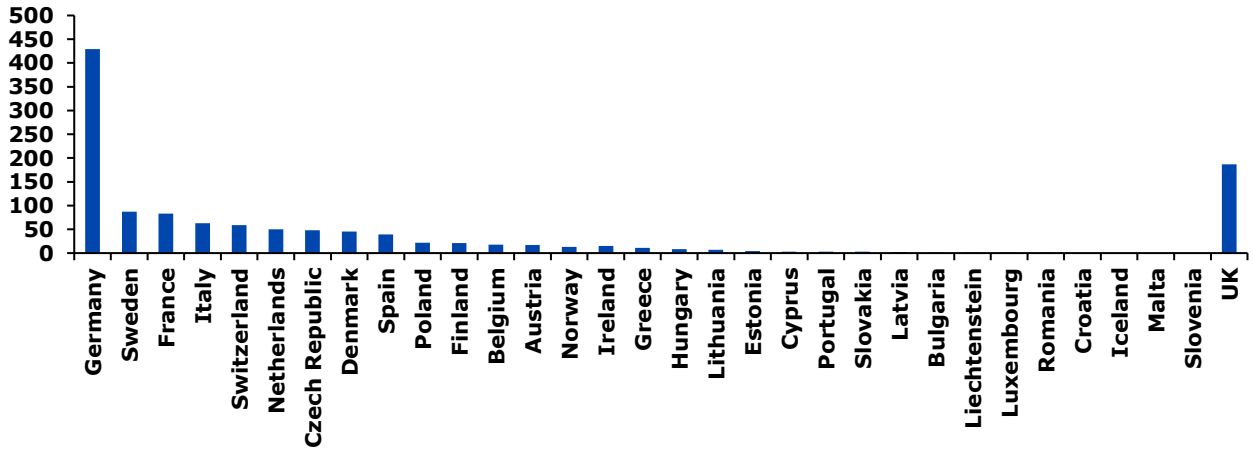

Figure 9. In the EU industrial NMs downstream users (n = 1054), most companies are based in Germany (41%), followed by Sweden (8.3%) and France (7.9%). UK is included for comparison purposes.

Based on data retrieved from relevant DBs, e.g., NanoWerk, Nanotechnology Products Database, the Nanodatabase, we estimate the number of NM-containing products (excluding NMs production) to be around 2,800 (Figure 10). A total of 2,200 products are estimated (78.6%) to be on the EU market and 600 on the UK market (21.4%).

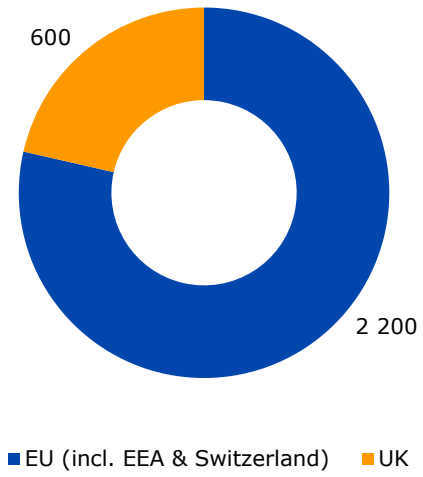

Figure 10. Estimated number of NMs-containing products in the EU (including EEA countries and Switzerland) and UK markets.

Germany has an EU market share in the production of NM-containing products of 35.4% (n = 785), followed by Switzerland with 20.4% (n = 453) and Sweden with 5.7% (n = 126), see Figure 11. The substantial number of NM-containing products in Switzerland (n = 453) compared to the number of companies present (Figure 6, n = 59) is attributed to the presence of large multinational companies in the fields of pharmaceuticals, instrumentation, food and feed etc. (e.g., Novartis Pharmaceuticals Corporation, Bühler AG, Nestle, La Prairie) offering a large number of products.

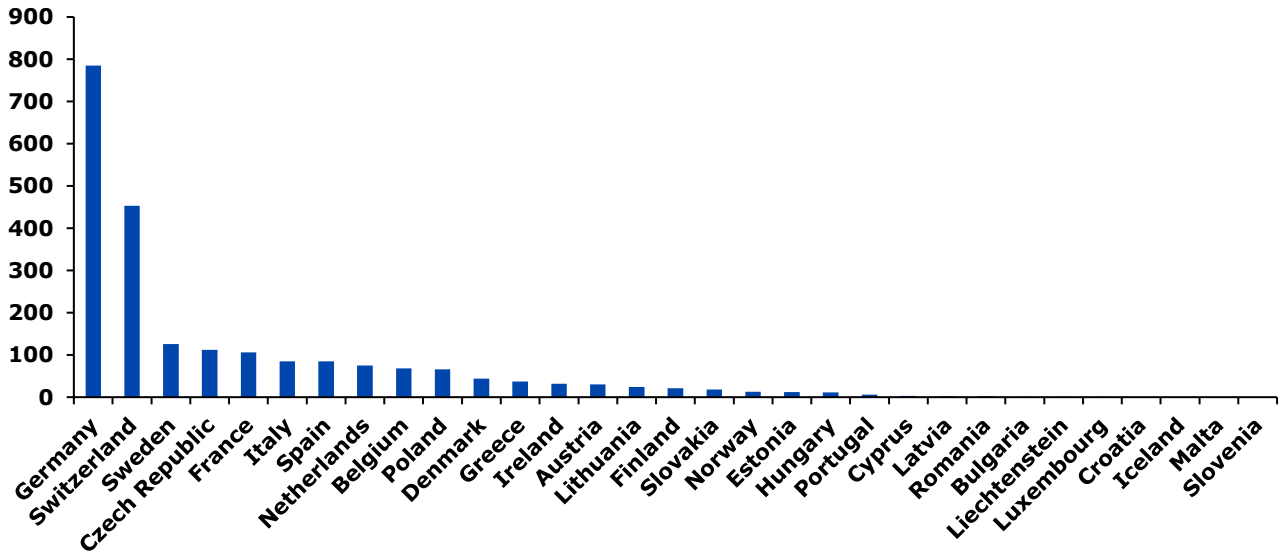

Figure 11. Estimated number of NMs-containing products in the EU (including EEA countries and Switzerland). Germany has a market share of NMs-containing products of 35.4% (n = 785), followed by Switzerland with 20.4% (n = 453) and Sweden with 5.7% (n = 126).

Company segmentation at a higher-level (Figure 12) demonstrated that most fall under the manufacturing segment (34.8%, n = 367), for example automotive, clothing, i.e., companies do not focus on a one market segment. Manufacturing is followed by Medicine & Life Sciences (14%, n = 147), demonstrating the significance and potential of nanomedicine on the EU market, especially if combined with the Personal Care segment (10.1%, n = 107), e.g., cosmetics including sunscreens. In this case, the Medicine, Life Sciences & Personal Care segment constitutes 24.1% (n = 254) of the total market. We need to note here that several of the companies within the manufacturing segment would fit in two or more of the other categories, which explains some of the low percentages calculated.

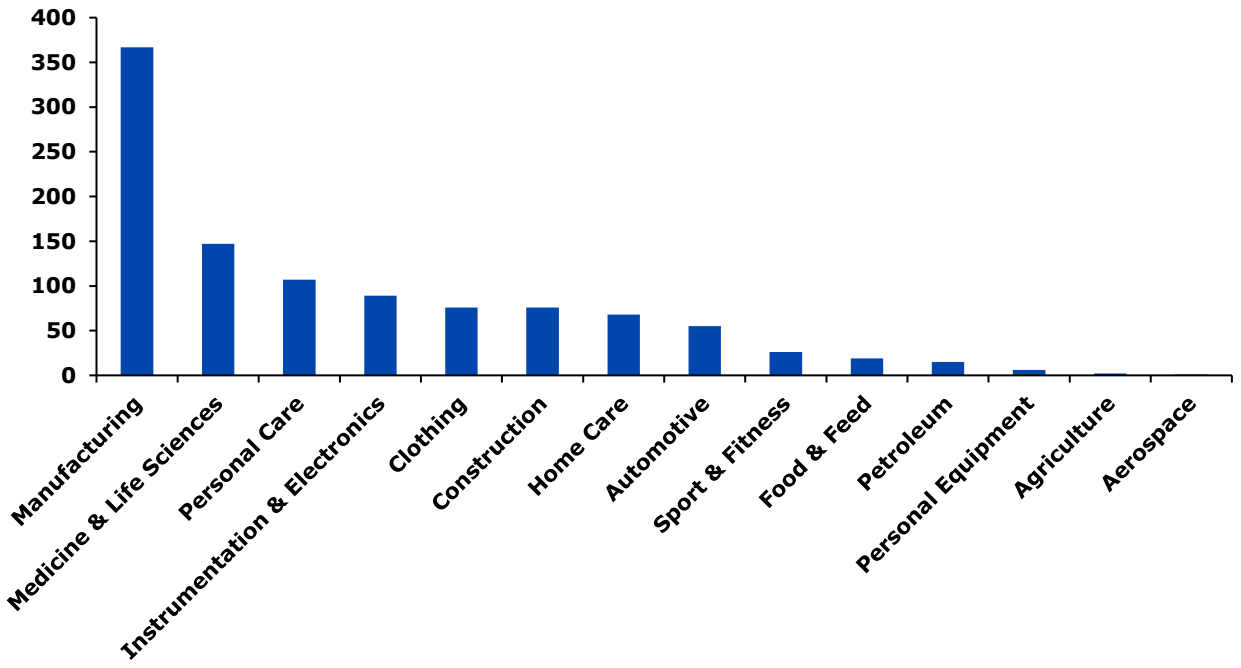

Figure 12. Number of NMs-related companies per market segment for the EU, EEA, and Switzerland NMs market.

Further segmenting the identified NM-related companies (Figure 13) for specific uses demonstrates a good balance between the manufacturing/construction segments and the nanomedicine/life sciences/personal care segments for the EU market. The Coatings, Paints and Sealants segments is the biggest (n = 198), with 18.8% market share. Close second is the Instruments and Electronics segment (n = 188) with 17.8%. These are followed by the Medicine & Life Sciences (11.3%, n = 119), Home, Garden and Environment (9.5%, n = 100), Cosmetics and Personal Care (9%, n = 95) and Textiles (8.8%, n = 93) segments.

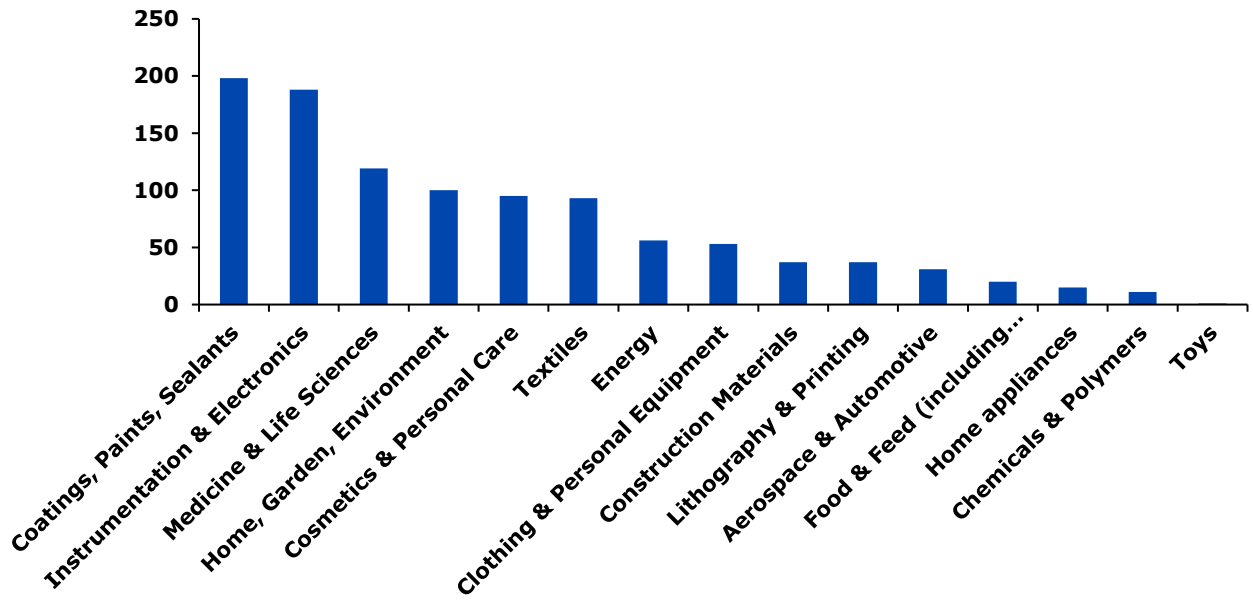

Figure 13. Number of NMs-related companies per use segment for the EU, EEA, and Switzerland NMs market.

Similarly, in the case of the UK market (Figure 14), the Manufacturing (n = 45) and Personal Care (n = 45) segments are the biggest with 24.2% market share each. These are followed by Clothing (10.8%, n = 20), Instrumentation & Electronics (10.2%, n = 19) and Medicine & Life Sciences (9.7%, n = 18). Again, combining the Medicine & Life Sciences and Personal Care segments would result in the highest segment of 33.9% (n = 63), which again demonstrates the dynamic and potential of this market segment.

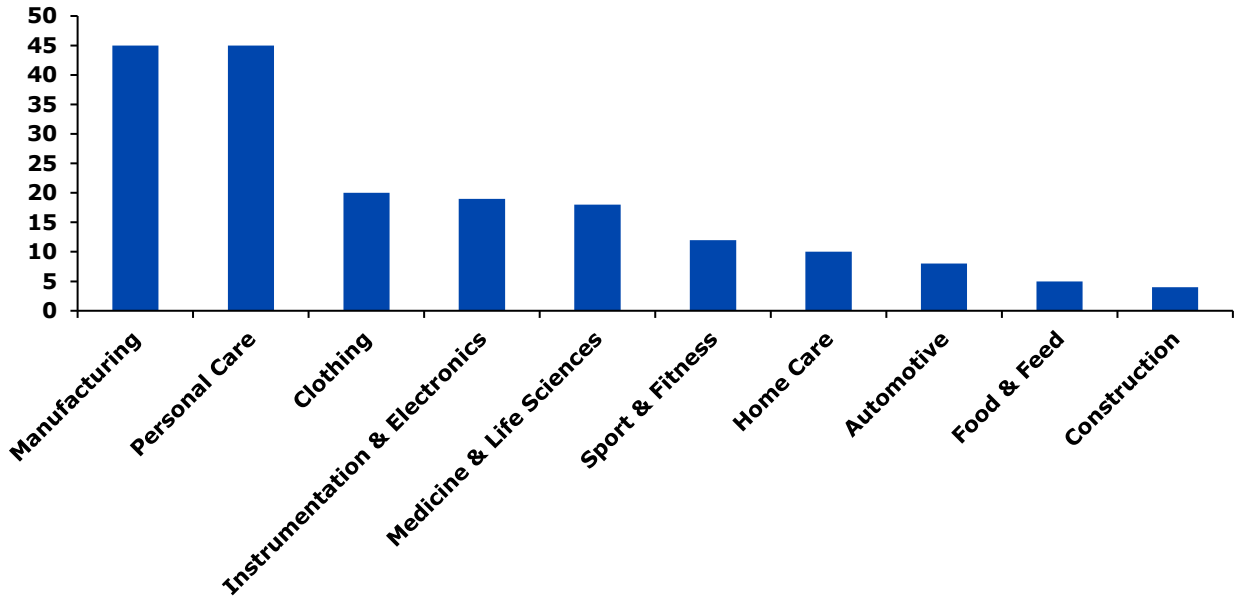

Figure 14. Number of NMs-related companies per market segment for the UK market.

For uses of NMs on the UK market (Figure 15), the Instrumentation and Electronics segment is the largest with a market share of 26.9% (n = 50). This is followed by Clothing and Personal

Equipment (21%, n = 39) and Cosmetics and Personal Care (14.5%, n = 27). Combining the Cosmetics and Personal Care with Medicine (8%, n = 15) leads to a segment of 22.5% (n = 42) with a lot of the Instrumentation & Analysis companies producing related equipment.

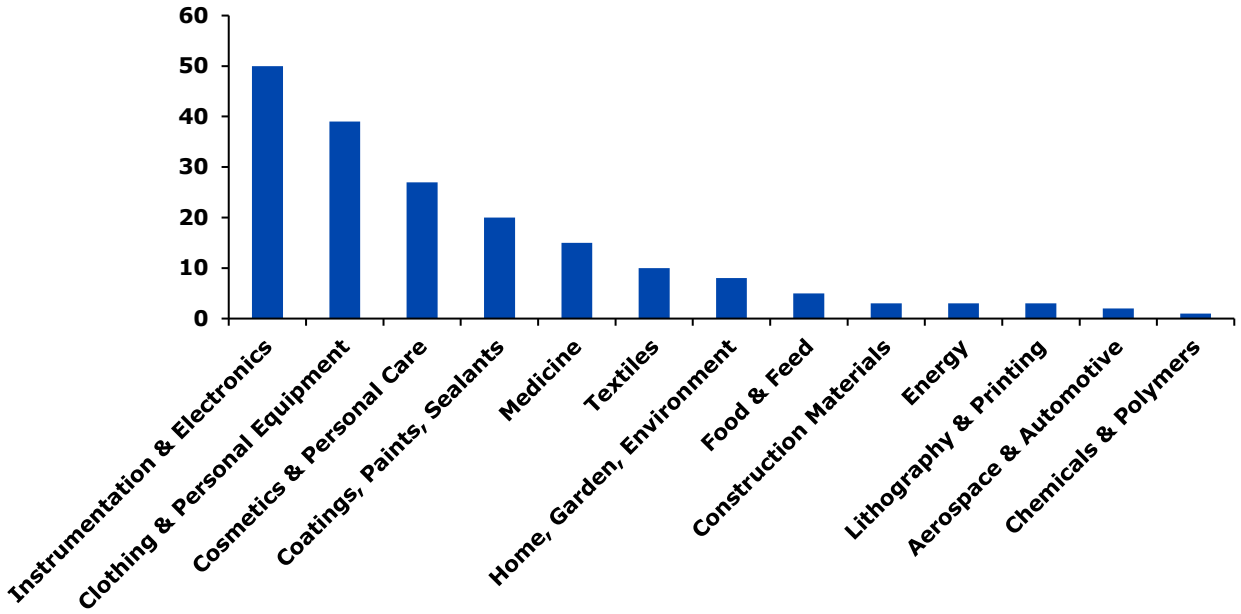

Figure 15. Number of NMs-related companies per use segment for the UK NMs market.

The remaining part of the EU NMs market consists of companies, which are part of the service sector (e.g., regulatory consulting, financing) or do software development. So far (Figure 16, Table A3 in the Annex), we have identified 27 EU, EEA, and Swiss companies and 9 from the UK. These are from the fields of software development, data analytics, consulting, trading, Research & Development (R&D), licensing, and funding.

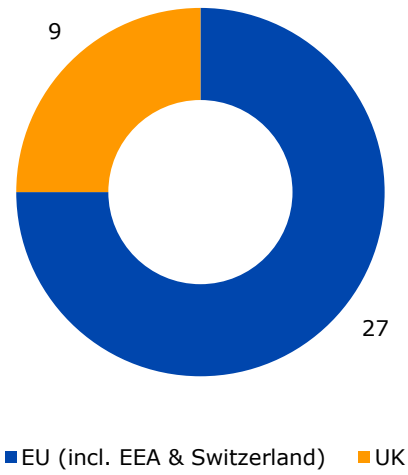

Figure 16. Number of NMs-related companies not dealing with the direct use of NMs. These include software development, data analytics, predictive modelling, consulting, trading, R&D,

licensing, and funding.

From the identified companies (Figure 17), 26% (n = 7) are based is Germany, followed by France and the Netherlands at 11.1% (n = 3).

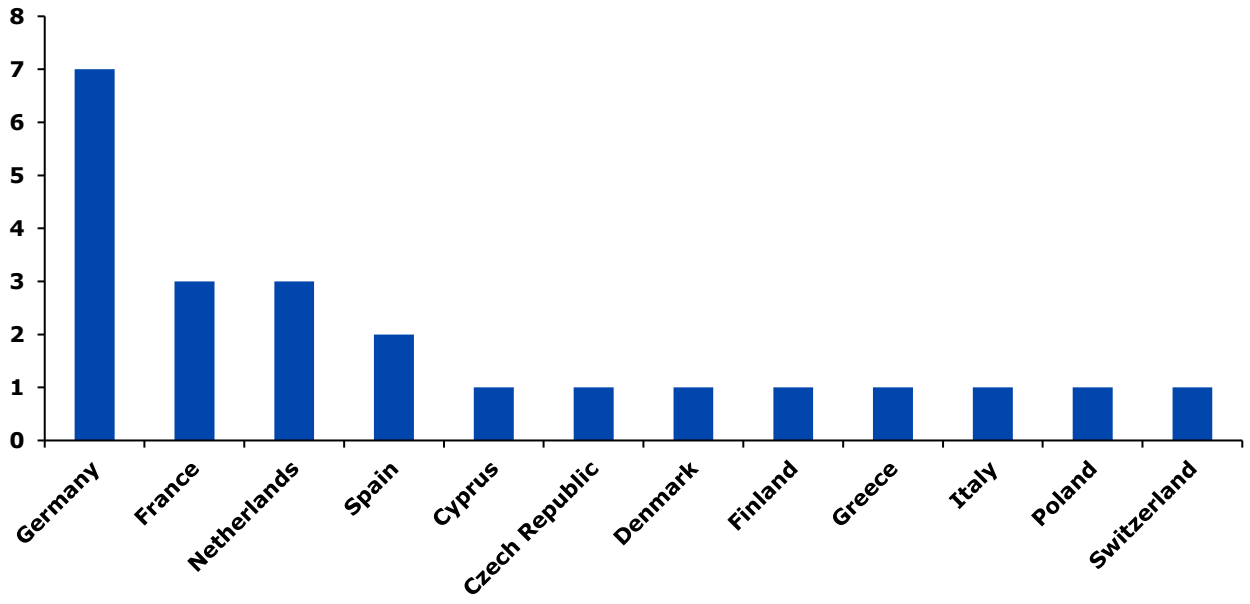

Figure 17. Number of NMs-related companies not dealing with the direct use of NMs per EU country.

Most of the identified companies (Figure 18, n = 12, 44.4%) work with data analytics, predictive modelling, and software development, which is expected taking into account the evolution of artificial intelligence (AI), machine learning (ML) and deep learning (DL) capabilities. These are currently intensely applied in the development of safe by design (SbD) strategies, the promotion of 3R (Replace, Reduce, Refine) principles to minimise animal testing and the acceptance of computational approaches in a regulatory setting. Next in order are the consulting firms (n = 6, 22.2%) either in a regulatory setting or for business development followed by the R&D and commercialisation companies (n = 5, 18.5%).

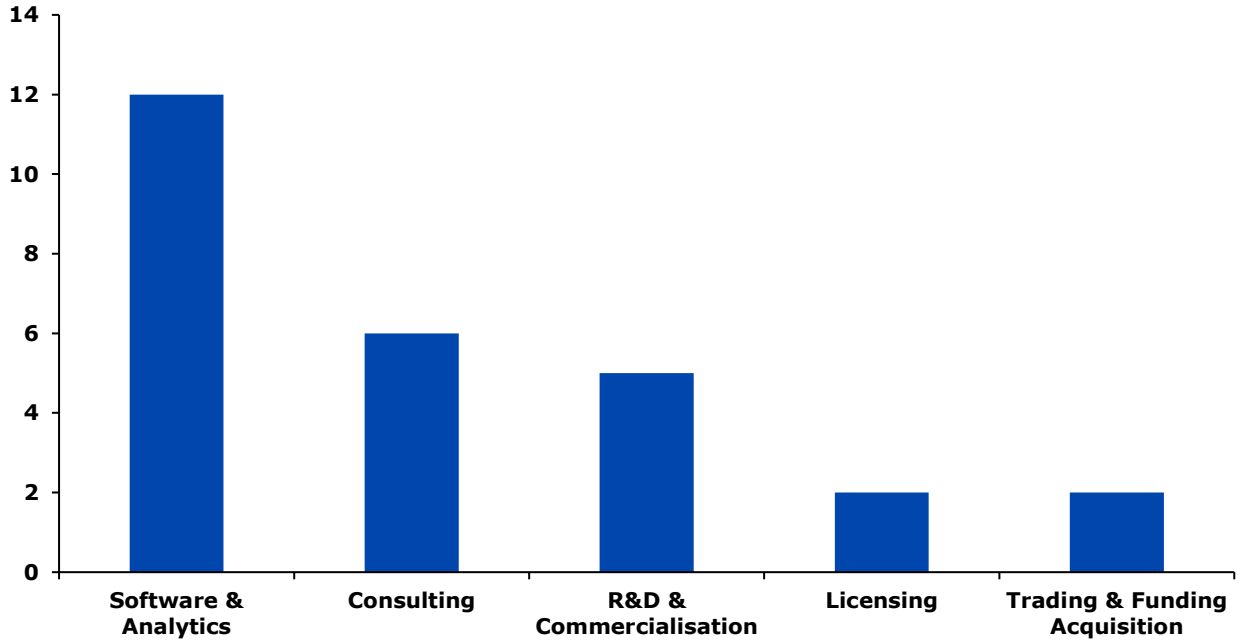

Figure 18. Number of NMs-related companies in the EU, EEA and Switzerland market per specialisation not dealing with the direct use of NMs.

Within the UK market (Figure 19) most companies are in the consulting (regulatory or business development, n = 4, 44.5%), which can be explained by the fact that the UK market is more service focussed. These are followed by the R&D and commercialisation companies (n = 3, 33.3%) and finally the Licensing and Software & Analytics (both n =1, 11.1%).

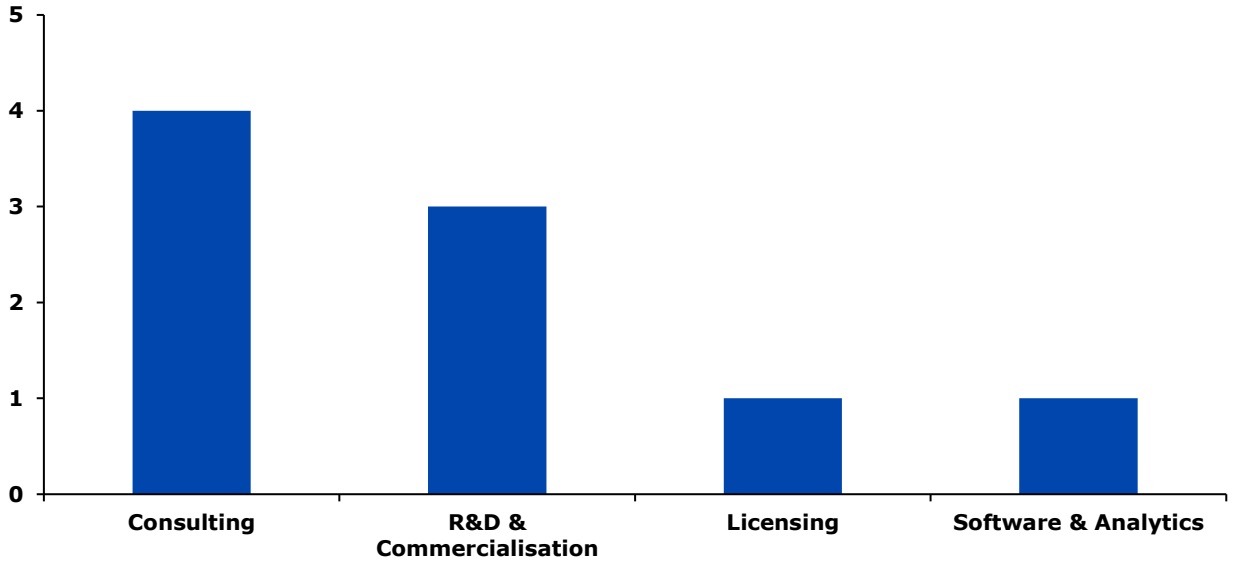

Figure 19. Number of NMs-related companies in the UK market per specialisation not dealing with the direct use of NMs.

4.2 Substances, unreported in EUON, identified as NMs on the EU market

The increased number of operators on the EU market and the emergence and advancement of novel and complex materials, e.g., quantum dots (QDs), doped NMs, leads to the conclusion that a substantial number of NMs exists in the EU market with regulatory obligations under REACH or under other European legislations. For this reason, we performed an online search in the public domain for NMs substances that exist and are not included in the EUON NMs DB (https://euon.echa.europa.eu/search-for-nanomaterials). The search was performed by scanning the substances available as NMs in the respective pages of the identified NMs producers, public research projects reports, accessible publications and available DBs and through the answers received from the questionnaires and personal interviews as presented in section 3.3. The list of these identified substances is presented in the Annex (Table A4). along with their CAS and EC numbers, where available.

During the search we identified 92 materials covering substances and mixtures (including doped NMs and inks), in addition to those listed in the EUON DB, available as NMs in the EU market. These materials are either designated as NMs by the providers or fall under the official EU definition for a NM or contain NMs. In some cases, especially in the case of larger providers (e.g., Sigma-Aldrich-Merck) the lack of a registration number in the safety datasheet (SDS) files was accompanied with a message stating that the substance had not been registered because either the substance or its uses are exempted from registration, the annual tonnage does not require a registration, or the registration is envisaged for a later registration deadline. This may apply to either the combined bulk and NMs 1 tonne / year production/importing threshold, which is the minimum volume requirement for registering a substance under REACH, or other EU legislation like e.g., biocides or Plant Protection Products (PPP) where NMs are covered by the existing registrations (https://ec.europa.eu/food/plants/pesticides/legislation-plant-protection-products-ppps_en) as the notification, assessment, and approval of the nanoscale form of an active substance must be carried out separately from any potentially existing non-nanoscale form. This inhibited us from identifying the status in each case. Another uncertainty, with respect to substance identification, is that smaller companies tend to not publish either the CAS/EC numbers or their safety (MSDS) files, which makes it hard to identify whether these substances are in the EUON DB or not. Another uncertainty originates from the lack of responses from several manufacturers that also inhibit the identification of substances.

Out of the 92 identified NMs-related substances or mixtures (Figure 20) 19 are carbon-based and the rest (n = 73) inorganic. Ten of those are pristine mixtures, 1 is a NMs-containing ink and 4 are doped NMs (Figure 21).

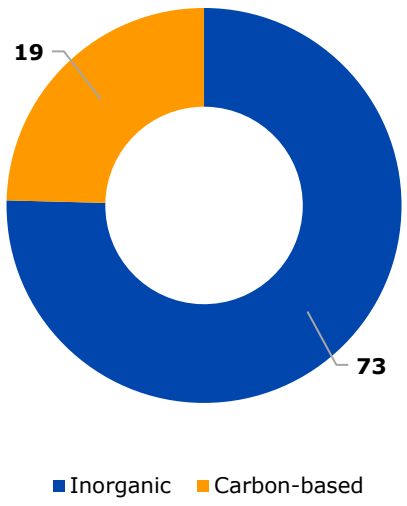

Figure 20. Out of the 92 not-reported identified substances, 74 (79%) are inorganic and 19 (21%) carbon-based.

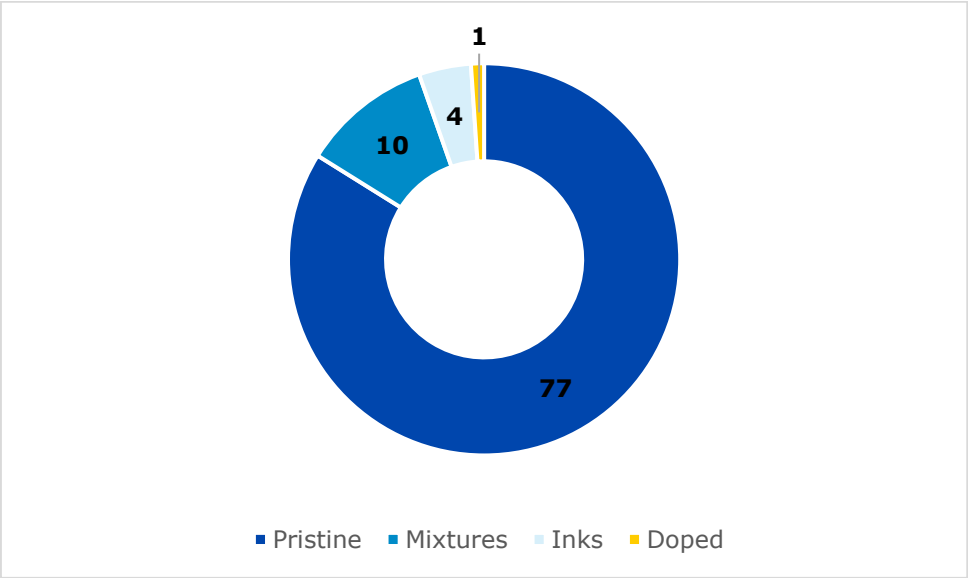

Figure 21. Out of the 92 not-reported identified substances, 10 (10.9%) are mixtures, 1 (1%) is an ink and, 4 (4.3%) are doped NMs.

Regarding the chemistry of the identified inorganic NMs substances (Figure 22), titanium (n = 13) and iron (n = 10) are the element mostly present, either as standalone metallic substances or in mixtures and doping. These are followed by aluminium, calcium, and zinc (n = 6), cobalt (n = 5), and silicon, tin, barium, cerium, nickel, and boron (n = 4). The remaining elements found in the identified NMs are cadmium, indium, selenium, copper, zirconium, gold, molybdenum, lanthanum, magnesium, yttrium, tungsten, silver, samarium, antimony, dierbium, dysprosium, europium, gadolinium, germanium, holmium, lutetium, manganese, neodynium, platinum, rhodium, ruthenium, strontium, telurium, tantalum, and terbium.

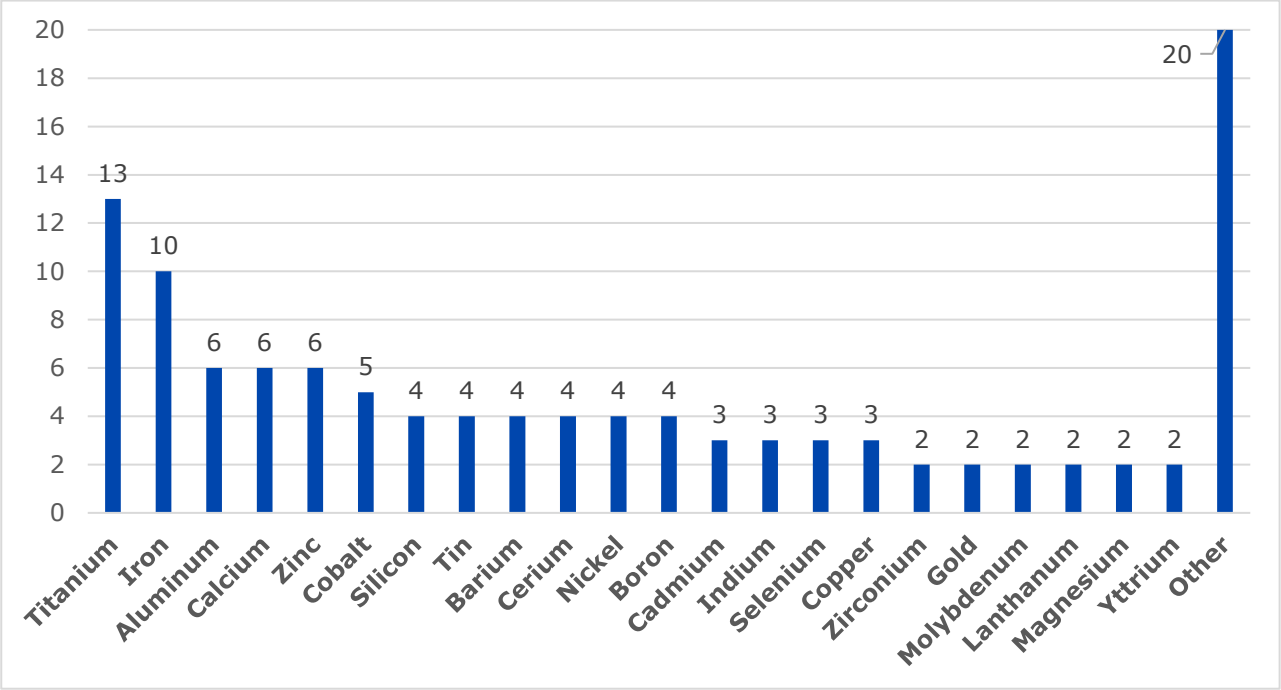

Figure 22. Presence of inorganic elements in the identified NMs substances, which are not listed in EUON. These may be as standalone metallic substances, part of mixtures as their respective oxides, inks, or dopants. The other category (n =1) included tungsten, silver, samarium, antimony, dierbium, dysprosium, europium, gadolinium, germanium, holmium, lutetium, manganese, neodynium, platinum, rhodium, ruthenium, strontium, telurium, tantalum, and terbium.

For carbon-based NMs (Figure 21), the majority are fullerenes (n = 6), followed by graphene (n = 5), carbides (n = 3), carbon-based (n = 2), diamonds (n = 1), 5-Fluoro-2,3-thiophenedicarboxaldehyde (n =1), and Styrene:Maleic Anhydride Copolymer 3:1 (n =1).

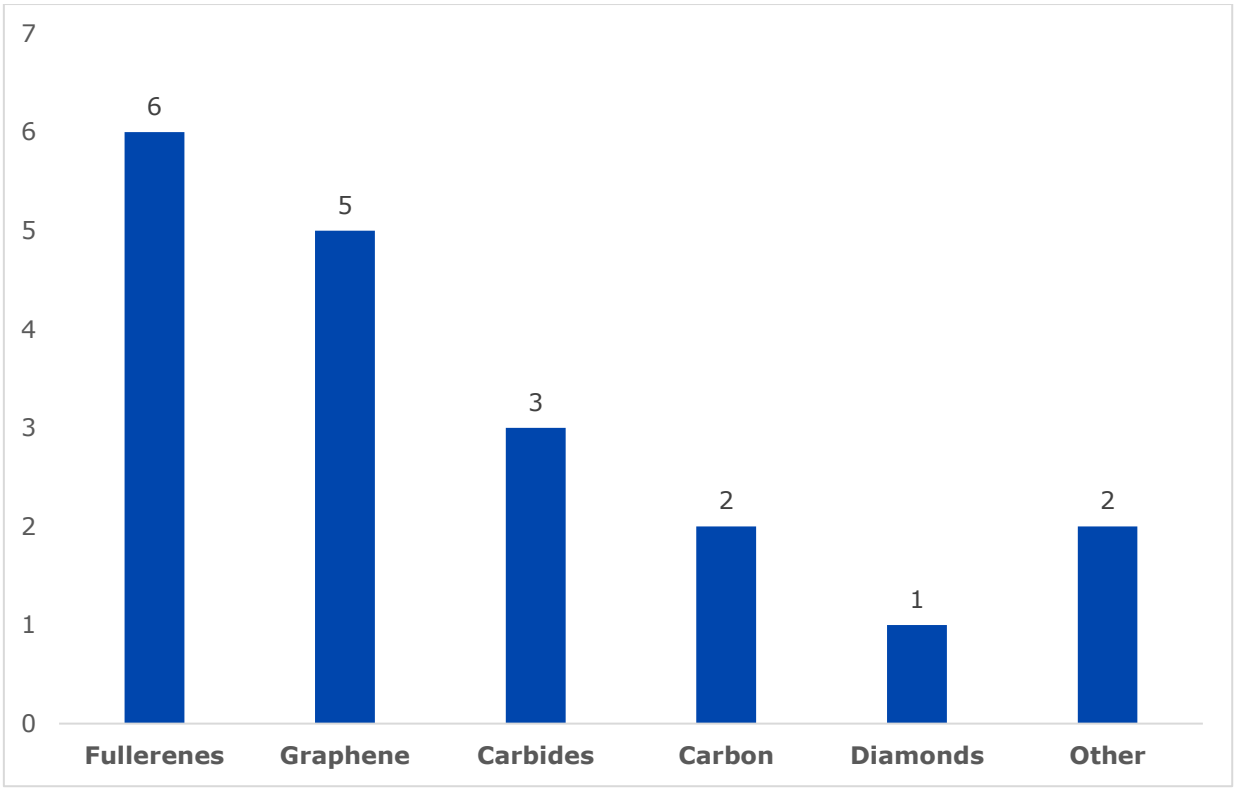

Figure 23. Distribution of identified carbon-based NM substances, which are not listed in EUON. These may be as standalone metallic substances, part of mixtures as their respective oxides, inks, or dopants. The other category (n =2) includes 5-Fluoro-2,3-thiophenedicarboxaldehyde and Styrene:Maleic Anhydride Copolymer 3:1.

4.2.1 Uses of NMs and existing uncertainties

The uses of NMs reported here are based on the EC definition for NMs [1], which is currently under revision [18]. Hence, the information presented here could be subject to change with a revision of the EC NM definition. Furthermore, considering the rapid technological advancement, the need for novel, advanced NMs with specific properties and the fluid nature of the market it is expected that the use of the identified NMs will substantially increase in the future. Especially carbon-based, and lanthanides, and actinides containing compounds are expected to increase due to their unique properties and usage in modern application like energy, communications, and electronics. For this reason, NMs, including those substances identified above, have several applications with respect to R&D and research projects, both in terms of NMs development and the use of NMs for the development of novel products.

NMs present unique, tuneable properties (e.g., via tuning of their size, surface properties or doping) and are used in a wide range of applications such as personal care and consumer goods, in household products (e.g., stain removal, anti-bacterial), as sensors, catalysts, heavy manufacturing parts (e.g., in composite materials for vehicles, aircrafts), coatings to improve the toughness and/or biocompatibility of industrial parts or implants, in electrodes or solar cells to enhance energy production and/or storage and as coatings/films on eyeglasses, screens etc. to make them antireflective or as ultra-violet (UV) filters or as additives in paints to make them self-cleaning, water repellent etc. [19], [20]. For example, the functionalised alumina NMs may be used in a wide range of applications that include the adsorption and separation of biomolecules [21], [22], water and waste-water purification [23], [24] and as additives in packaging, paints, coatings, pharmaceutical, cosmetics and fuels [25]–[28]. Similar usages are being reported for the titania and silica NMs, other instances of which are already being used in such applications.

Based on a study by InkWood research [4], the European NMs market is expected to grow with a compound annual growth rate (CAGR) of around 15% by 2028, with an average volume increase of 15.6%. These predictions consider current issues arising from the ongoing SARS-COV-2 pandemic, which led to closures of plants across Europe mid-2020. Some of the key drivers of the market will be the increasing demand for state-of-the-art electronic devices [4], [29], [30], energy storage (e.g., batteries, solar cells) [31], increasing public funding for the development of complex and advanced (nano)materials with unique properties [32], technological advancement with respect to NM manufacturing processes leading to cost reduction [29], [33], [34] and, last but not least, the advancement of nano- and personalised medicine [35]–[38]. On the other hand, the key inhibitors in the growth of the NMs market are the regulatory landscape, with the emerging nano-specific data requirements [39], [40] regarding their possible environmental and hazardous effects, the current high manufacturing cost and the need for societal acceptance [41]–[44].

In general, the NMs market, with respect to the type of NMs can be divided into six (6) segments, containing the NMs identified in the section 4.1 as well. These include [4], [19]:

1. Metal oxides:

- Titanium Dioxide (TiO_2)
- Zinc Oxide (ZnO)
- Silicon Dioxide (SiO_2)

- Aluminium Oxide (Al_2O_3)
- Cerium Oxide (CeO_2)
- Antimony Tin Oxide (ATO)
- Copper Oxide (CuO)
- Bismuth Oxide (Bi_2O_3)
- Cobalt Oxide (CoO)
- Iron Oxide (Fe_3O_4, Fe_2O_3)
- Magnesium Oxide (MgO)
- Manganese Oxide (Mn_2O)
- Zirconium Dioxide (ZrO_2)

2. Metals & Quantum Dots (QDs):

- Silver (Ag)
- Gold (Au)
- Nickel (Ni)
- Platinum (Pt)
- Palladium (Pd)

3. Carbon-based NMs:

- Carbon-black
- Carbon nanotubes (single, double- or multi-walled)
- Graphene and graphene oxide
- Fullerenes
- Graphene Quantum dots

4. Dendrimers, polymers

5. Nanoclays

6. Nanocellulose

Currently, the metal oxides NMs market is the largest segment of the EU market per value adding up to about 75.7% of the total. This is followed by the carbon-based NMs (14.2%), metallic NMs (8.3%), nanoclay (1.2%), nanocellulose (0.5%), and dendrimers (0.1%) [4]. According to Inkwood research, titanium dioxide is the most traded NM on the European market with a market share of 40%, followed by silicon dioxide (35.4%), and zinc oxide (18.5%). The remaining market share for aluminium, cerium, copper, and iron oxides etc. is below 10%.

Metal oxides, due to their versatility, are used in nearly all application-segments of the NMs market such as microelectronics, fuel cells, coatings, catalysts, medicine and imaging. Metal oxides have also been at the centre of research regarding their hazardous potential, if released to the environment and biological systems [45]–[47]. Their usefulness is further enhanced due to the potential to finetune their properties via e.g., doping, surface treatment. For example, the use of TiO_2 NMs as UV filters in glasses or as additives in paints can be improved by doping with e.g., Zirconium (Zr) or Hafnium (Hf) which will modify their absorption wavelength [48].

Similarly, the use of metal NMs is expected to substantially increase based on the increased demand for use in consumer products, electronics, and manufacturing, combined with a decrease in the cost of production by upgrading the manufacturing processes. Currently silver has the biggest market share with 35.6% of the total metal NMs, and it is only surpassed by the combined segment of all metallic QDs (55.1%). QDs and wires, in particular, will play a significant role in this increase, and substantial R&D work is undertaken to bring novel QDs to the market recognising their superior properties and performance in optoelectronics applications, medicine, agriculture etc. [49]–[53].

Carbon-based NMs (CNTs, graphene, fullerenes) are one of the most up and coming NM segments due to the physicochemical, optical, thermal, and electrical properties, which, combined with their high mechanical strength, make them ideal for a number of industrial applications [54]–[59]. Furthermore, carbon-based NMs are highly researched in the current R&D and nanomedicine projects, e.g., [60]–[66], something also visible from the increased number of NM producers in the market.

The market for dendrimers and nanoclays is also expected to increase in the future. Dendrimers are tree-like versatile molecules that based on their structure can lead to different shapes, sizes and functionalisation and hence physicochemical properties. They have wide applications in biology and nanomedicine, e.g., drug delivery, imaging, photodynamic therapy, anti-cancer drugs, Magnetic resonance imaging (MRI) [67]–[69], although again the future regulatory landscape will play a key role regarding the scale of use. Similarly, the layered mineral silicates structure of nanoclays, along with their organically-modified analogues, make them suitable for use in a wide range of applications in construction, polymer nanocomposites, as rheological modifiers, gas absorbents and drug delivery carriers [70]–[74]. The filtering capabilities of nanolayers, combined with the increased needs for water cleansing and purification, will be one of the main drivers of growth, assuming increasing R&D projects in the following years [75]–[77].

Finally, nanocellulose is already used in a wide range of applications such as paper, composites, food, absorbent and hygiene products, emulsion and dispersion, oil recovery, medical, pharmaceutical, and cosmetics, demonstrating its usefulness and functionality [78]–[80].

Based on the above, and the commercial operators presented in section 4.1, it is evident that NMs are already extensively used in different application-segments of the EU, EEA, and Swiss market.

Key applications include coatings, paints, and sealants, as they can act as water/pollution repellents, absorb UV radiation, improve hardening and stability etc. Other materials used in paints include SiO_2, Ag, Cu, and ZnO. In the case of Ag, its antimicrobial properties means that it can protect from bad odours, mildew and various bacteria strains, while being less toxic than some other biocides [81]–[83]. Similarly, nano-Cu has been shown to exhibit antimicrobial properties, while being less toxic than its bulk analogue that has been shown to induce reactive oxygen species (ROS). It must be noted that all types of NMs are being used in 'coatings, paints, and sealants', for example CNTs, nanocellulose, and nanoclays in addition to the ones already mentioned. NMs provide superior performance in blocking fluids passage from joints or surfaces. In addition, pigments and nanopigments have been the subject of a dedicated literature and inventory analysis in 2018 [84]. This analysis defined nanopigments as NMs used as pigments

and 81 substances were definitively identified as nanopigments (including 4 extender/filler pigments). One of the uncertainties linked to the EU, EEA and Swiss NMs market is the way national inventories treat nanopigments. For example, the Danish Product Register specifically exempts nanopigments used in paint, wood preservative, glue, fillers, and other uses [84] from reporting to its nano-inventory.

NMs are widely studied and already used in biotechnology, medicine, and consumer goods and this was evident by the size of the combined market segment of operators. Nevertheless, substantial evaluation and testing of the potential hazardous properties of NMs are needed before specific therapies are developed, which then need to be approved by authorities like the European Medicals Agency (EMA). A similar situation exists for consumer goods, like cosmetics. Specific uses include products for skin, hair, nails and more to deal with ageing, hyperpigmentation, dandruff, and hair damage. The use of NMs is based on their ability to stay on or penetrate the epidermis and deliver specific substances in a controlled and sustained rate; examples of NMs are metal oxides, liposomes, niosomes, nanoemulsions, microemulsions, solid lipid nanoparticles, nanostructured lipid carriers, and nanospheres. To this end, the definition used in each case (e.g., inorganic vs. organic NMs) may introduce uncertainty with respect to the NM landscape as different definitions may lead to different conclusions with respect to the producers and downsteam users. Again, the direct exposure of humans and the increased environmental release potential is a factor that can introduce uncertainty in the introduction of new NMs in the market.

One of the most promising uses of NMs (e.g., metal oxides, metals) is in the energy sector, as their unique properties (especially at sizes below 10 nm) enhance electron transport and band engineering [85]. As a result, NMs are used or tested for energy production and storage applications [86]–[88]. The use of NMs in Li-ion (and other) batteries and in cells and panels for energy production has been proven to substantially enhance their performance. NMs offer the potential of manufacturing smaller more reliable, with higher processing potential and energy efficient devices.

In the electronics sector, several companies are producing components, which may contain NMs, at the range of up to 20 nm (e.g., Intel, IBM, Nvidia) that are being used even in Personal Computing. Another promising application is the development of magnetic random access memory (MRAM), which can be produced using magnetic NMs [89], that will substantially enhance the performance of computer systems [90]. Currently there are a few start-ups in Europe working on the development of such systems [91], [92] while there have been EU-funded projects [93], [94] studying the MRAM potential. MRAM is enabled by nanometre-scale magnetic tunnel junctions and can quickly and effectively save data during a system shutdown or enable resume-play features. Other applications include the development of flexible, bendable, foldable, rollable, and stretchable electronics that are being currently being used in smart phones, computing, wearables, medical applications and more [95]–[99] or ultra-high-definition displays and televisions that are using QDs to produce more vibrant colours while being more energy-efficient [100]–[103]. Graphene and cellulosic nanomaterials are being used in the production of various types of flexible electronics to enable wearable sensors and other computing and electronic products like Flash memory chips for smartphones and thumb drives, ultra-responsive hearing aids, antimicrobial/antibacterial coatings on keyboards and cell phone casings, conductive inks for printed electronics for smart cards/smart packaging, and flexible displays for e-book readers [104], [105].

Other NMs uses include the food and textiles industries, where CNTs, oxides, metals, nanoclays and more are used or tested [106]–[111]. Their uses are aimed as part of coatings, fibre materials to produce long-lasting products with antibacterial properties. Similar NMs are also used in food packaging, while studies are aimed at NMs that will change food taste, improve food safety, and enhance the health benefits offered by food.

5. Questionnaires and interviews with market operators

To acquire a clearer picture for the EU, EEA, and Swiss NMs market, we have performed an online survey (see Annex for full survey) addressing the NMs available on the EU market. The survey targeted mainly the identified NMs producers. Direct contact was attempted via email, while the survey was publicised in social media and the EUON website. In total, we received 28 responses, and noted that for 2 organisations two responses were received from two different respondents. This accounts for 32% of the EU and associated countries NMs producing / handling / importing companies contacted (n = 88), and would decrease to 29% if corrected for the double response from two organisations. We need to note that the survey was shared with the UK companies as well, but none responded, which is probably a reflection of Brexit and their current focus on adapting to the forthcoming reporting for UK REACH.

Based on current baseline standards, online market surveys have a response rate of 10-30% [112]–[114], with a response rate of 50%+ considered an excellent result. This rate is linked to the incentives offered and is in line with the response rate of medium length surveys (12-25 questions) for which the expected response rate is 15-30% if the survey includes both 1 follow-up and incentives; this rate falls below 10% with only 1 follow-up [112]. In our case we performed 1 follow-up, and no clear incentives were offered. As a result, we consider the response rate of 32% as satisfactory.

During the survey a series of risk mitigation measures were applied. First and foremost, we did our utmost to prepare an extensive list of NM producers from the entire EU market and associated countries, to ensure the optimum representation of stakeholders. One of the key barriers was the lack of communication from UK-based companies, which is attributed to the current Brexit uncertainty, in terms of regulations, trade barriers and recognition between the two, now distinct, markets. In any case, the survey was launched as soon as it was approved by ECHA/EUON. The contacted stakeholders were offered 3 ways of completing the survey, the first being an online form. They were also offered the opportunity of a live interview with a representative for NovaMechanics, or to fill in the questionnaire offline using the provided Word document. The latter option turned out to be the most popular as it also allowed participants to see the whole range of questions and to prepare their responses in a manner that allowed corporate sign-off at various levels, as required by larger companies. As mentioned in section 2.3, the survey needed at the most 10-15 minutes to complete, so as not to tire the participants. This was achieved in close collaboration with ECHA/EUON by refining the questions and reducing as much as possible the free-text questions and the expected response time was clearly communicated to the contacted stakeholders. Several of the questions remained hidden and were only presented to the participants as relevant, based on previous answers. Participants had also the opportunity to submit the survey even if they did not reach the end of survey.

The received responses originated (Figure 24) from Austria, Greece, Ireland, Portugal, USA, Norway, France, Belgium, Latvia, Spain, Italy, Germany, Luxembourg, Denmark, Estonia, and Switzerland.

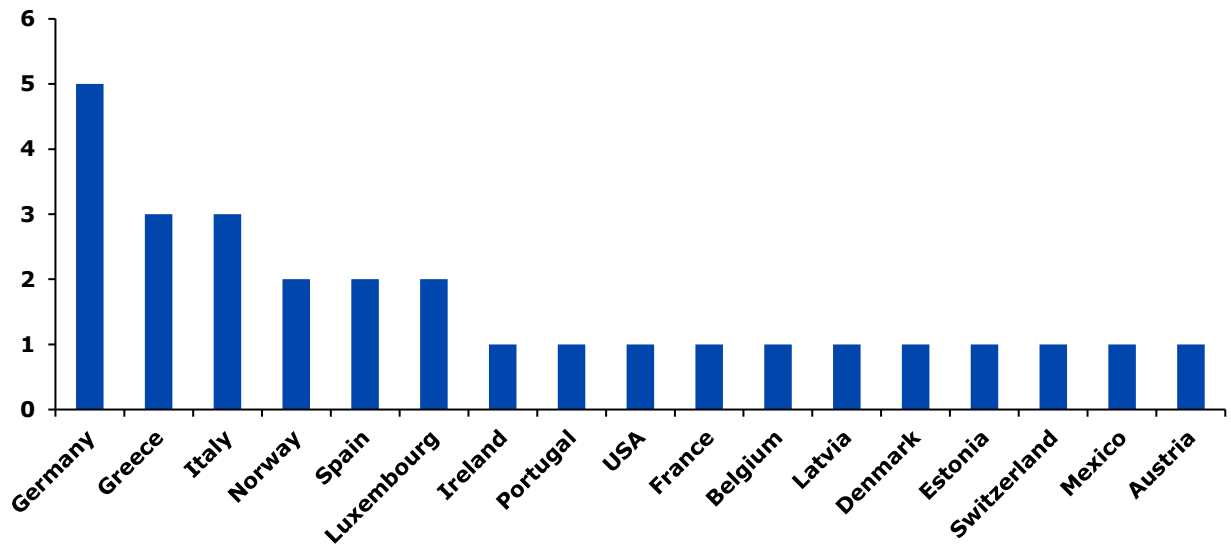

Figure 24. Distribution of survey responses per country.

From the respondents, 5 companies stated that they do not produce NMs within the EU or that they do not fall under the current EU NM definition [1]. Two companies import NMs onto the EU market, and 2 respondents are downstream users within the EU market as well. The NM substances that in general were mentioned in the responses were single- and multi-wall carbon nanotubes (SWCNTs and MWCNTs), graphene, fullerenes, metals (e.g., silver, cobalt) and metal oxides (e.g., titania, iron oxides, zinc oxide) and others (e.g., tungsten carbide and silicon carbide). Similarly, the NMs imported onto the EU market include SWCNTs, MWCNTs, graphene, fullerenes, silicon carbide, tungsten carbide and titanium dioxide. These and similar NMs are being used by downstream users.

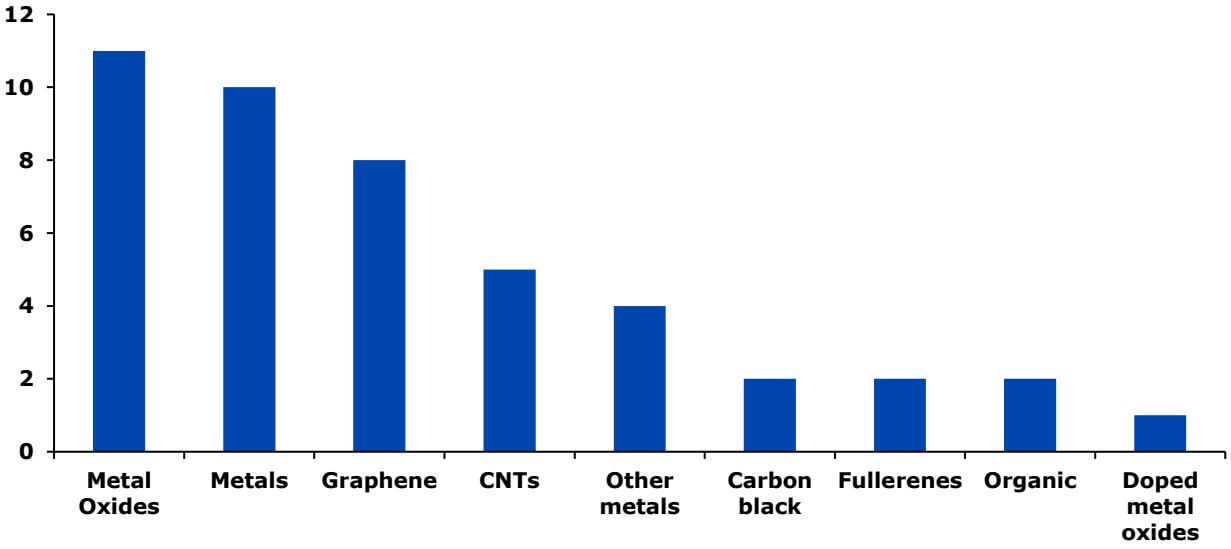

Figure 25. Distribution of NMs segments produced or imported in the EU, EEA, and Switzerland market reported during the survey.

From the respondents, two companies are producing NMs at above 1 tonne per year, 1 is a

downstream user of NMs at > 1 tonne/ year and 1 is importing NMs onto the EU market at volumes greater than 1 tonne per year. These companies have registered their substances (NMs) under REACH. The volumes produced/imported by the remaining organisations are well below the 1 tonne per year threshold, and the organisations are thus not required to register under REACH.

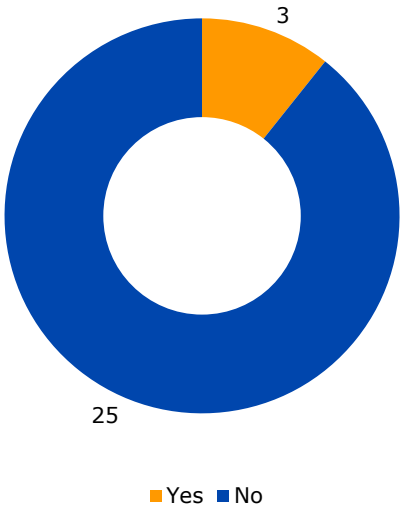

Figure 26. Number of companies producing or importing NMs at volumes great than 1 tonne per year.

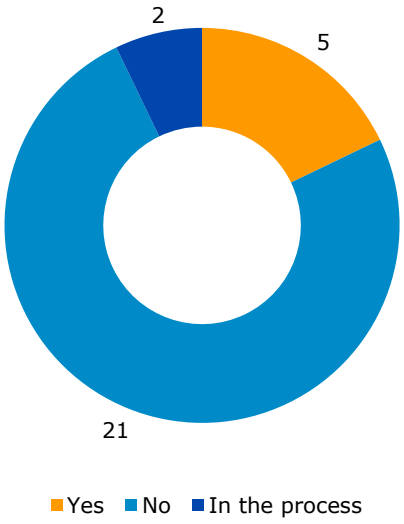

Figure 27. Have you registered your NM products with REACH?

The substances available as NMs on the EU market are being used, as per the respondents, in a wide variety of applications. These include photovoltaics and printed electronics producers within EU, cosmetics and supplements producers, research, and academic institutions worldwide, paint and pigment producers, academia, colloids for diagnostic devices (e.g., lateral flow strip test immunoassays), printed electronics and Anaerobic Digestion/Biogas Production companies, R&D for optics and spintronics, chemical supplies, coating, polymer industry (rubber, thermoplastics), concrete and more.

5.1 Overview of the NMs market outlook

Based on the responses received (Figure 28, 1 respondent did not provide a prediction), 78% of the respondents (n = 21) believe that the NMs market will be bigger in 5 years' time. These organisations cover the entire spectrum of the NM segments, strengthening the initial analysis showing the positive potential of the EU market, which is also mirrored in the NMs market projections. Five responses (18%) stated that the NMs market will remain the same in the next 5 years, and 1 (4%) smaller, which was based on the changing, towards stricter rules, regulatory framework. Combined with this, most of the respondents (41%, Figure 29) believe that the current regulatory landscape is neutral with respect to the growth of the EU NMs market, which was closely followed by negative impact (37%), and with the positive impact lagging with 22%.

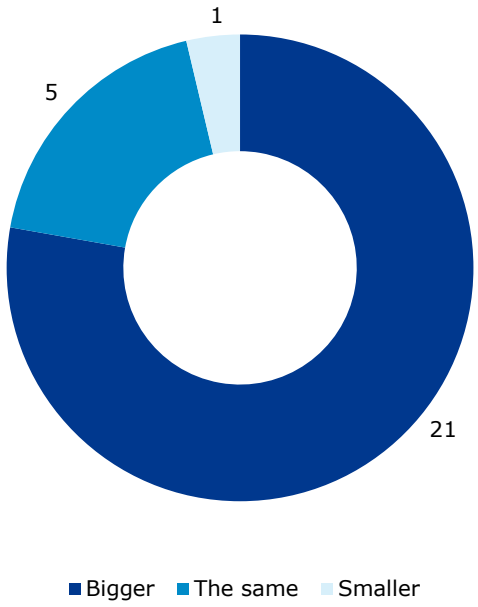

Figure 28. How will the EU NMs market will look in 5 years' time?

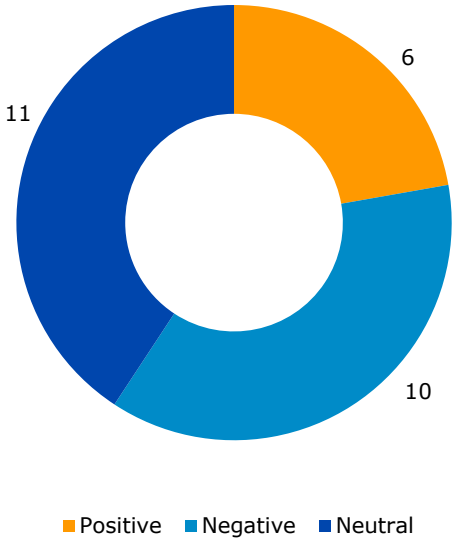

Figure 29. How do you think the current regulatory framework affects/will affect the EU nanomaterials market?

The projected EU NMs market growth (Figure 30) is especially high for the carbon-based NM segment (CNTs, graphene, fullerenes), with suggestions being between 50% - 100% for all types. In fact, one respondent suggested that the graphene market will be 100% bigger in volume and 20 times bigger in value, in agreement with the personal interviews as well. Similarly, the metal NMs market was estimated to grow around 50%, and by 10 tons per year. This optimism is further expressed in the amount of new NM-containing products within 5 years' time (Figure 31). Fifty-four percent think that there will be 25% or more products in the market, 19% more than 10%, 8% more than 5% and only 15% that the number of products will remain the same. This is accompanied by 76% believing that this will be accompanied with the emergence of new NMs in the market. The projected growth is believed to be driven by the carbon-based NMs, including alloys (carbides), other types of 2D-materials, with two main fields of growth, i.e., medicine and energy.

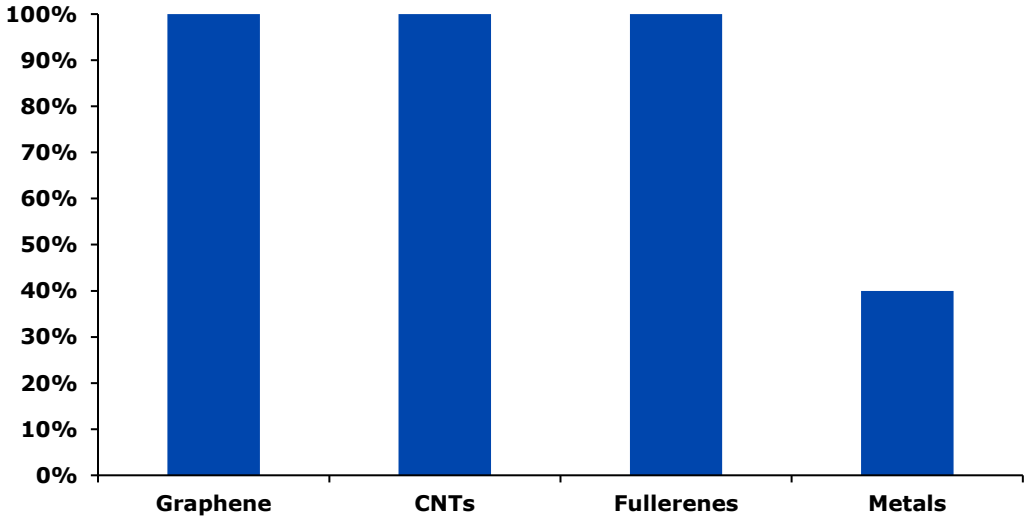

Figure 30. Estimated market growth, based on the survey responses, for the carbon-based and metallic NMs.

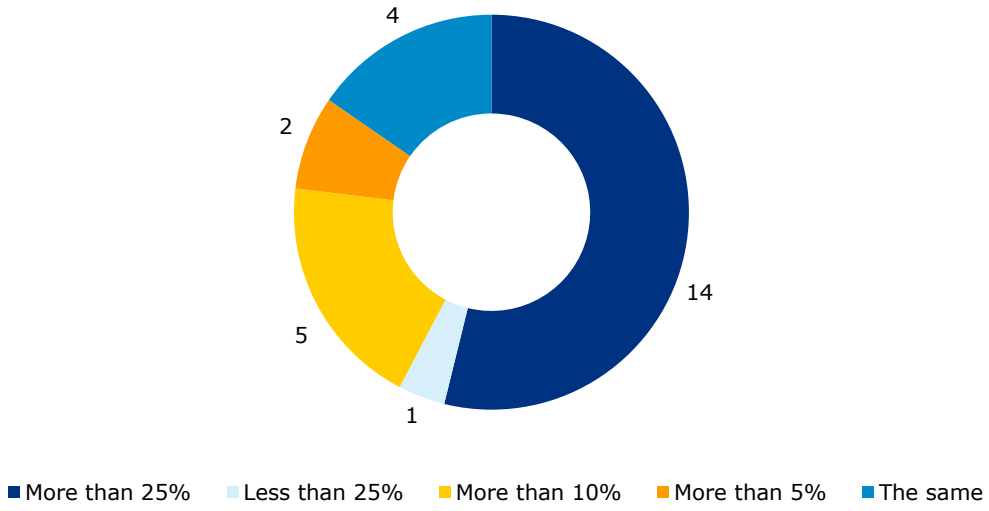

Figure 31. Estimated change in the number of NMs-containing products in the EU market, based on the survey responses.

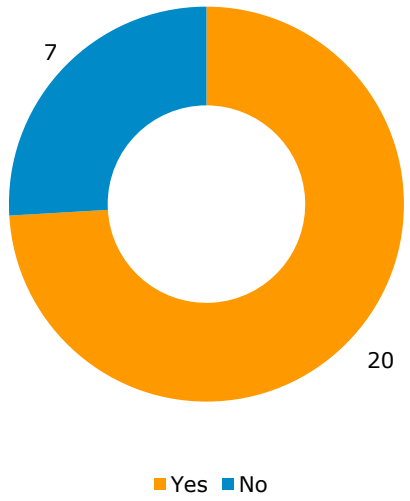

Figure 32. Do you foresee the emergence of new nanomaterials as substances and/or nanomaterials-containing products on the market?

The main barrier (Figure 33) to market growth was reported to be in the scaling up of the manufacturing processes of all types of NMs and products, like processability (dispersion, mixing), safety in the workplace, standardisation of the production cycle of upstream clients, including a transition from laboratory to large-scale production, factors which are considered time and money consuming. The regulatory landscape and the registration requirements were also mentioned as a potential barrier, with the lack of guidance on bottom-up clinical trials being an interesting mention. This was followed by potential health and safety issues, especially in the mid- to long-term along with related public perception. The environmental impact of NMs was

only considered by 1 respondent, same as market fragmentation, with many small players and expensive NMs. While we don't have an overview of the NMs cost, market fragmentation is evident in the market operator study presented in section 2.2. Considering the number of market operators identified (around 1,150 on the EU market), the number of estimated products excluding NMs production (around 2,200) and the presence of large multinational companies with many offerings, market fragmentation could be indeed an issue, as the cost for standardising and scaling up manufacturing processes could be prohibitive for SMEs and start-ups. As a result, market fragmentation can be directly linked to the manufacturing processes barrier, which could be overcome by collaborations and alliances within specific NMs and market segments.

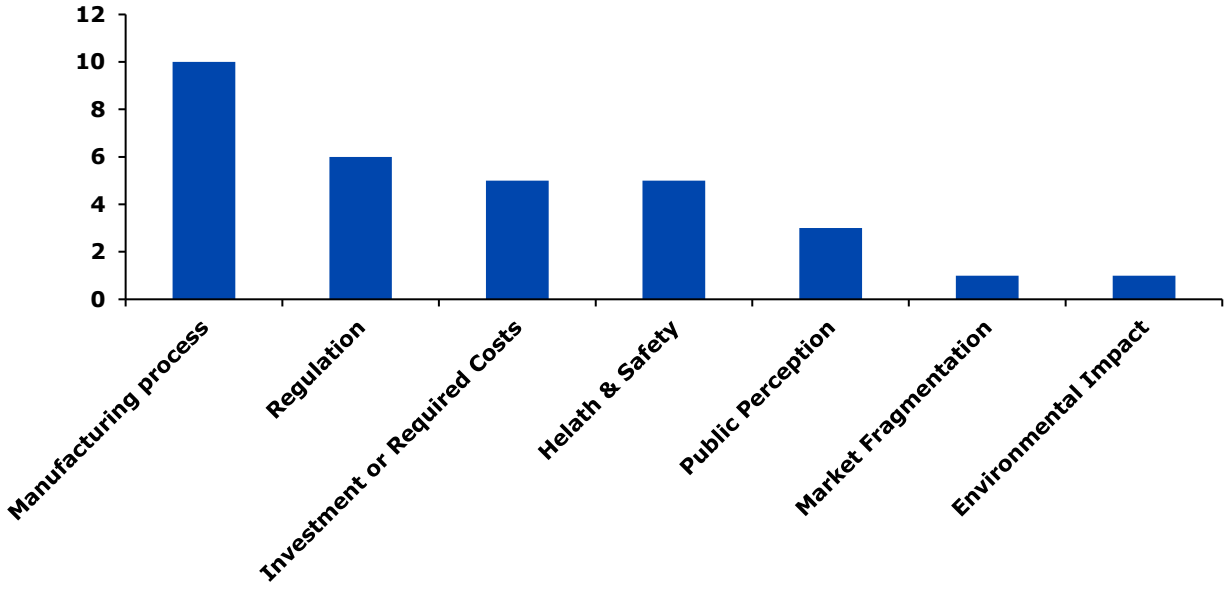

Figure 33. EU NMs barriers and respective mentions during the survey.

The current regulatory landscape was mentioned as the reason for the EU NMs market losing momentum and that it had been overrun by less regulated markets like Asia. The regulatory landscape was repeatedly mentioned as a barrier to NMs growth by several respondents. A characteristic example mentioned was about the call from the French ANSES (French Agency for Food, Environmental and Occupational Health & Safety) for restrictions to be placed on nanomaterials as a precaution, which would mean a substantial reduction in the nanomaterials market. Examples of such cases could be changes in the classification of NMs (e.g., TiO_2 as a suspected carcinogen (category 2) by inhalation) [115], or the inclusion of carbon nanotubes on the ChemSec Substitute it Now (SIN) list [116], [117].

In separate interviews it was mentioned that within the carbon-based NMs market there were thoughts of identifying alternative approaches (e.g., using polymers) with similar properties to overcome the potential regulatory hurdles, although it is not clear if the fact that there are discussions among legislators to revise the legal context for polymers will impact this approach. This view was not shared, though, by all interviewees. Similarly, 2 interviewees stated that the NMs are not per se hazardous and that it is a case-by-case approach, which includes the stability of the NMs and the release potential.

On the other hand, the stricter EU regulatory landscape could increase public trust in the NMs

market and the resulting products, which is currently considered to be mostly negative (total 46% including neutral to slightly negative, Figure 34). Considering the effects of the ongoing SARS-COV-2 pandemic on the lifestyle of Europeans and the current shift towards healthier lifestyles, means that stricter legislation and higher transparency from the EU NMs market operators can increase public confidence and boost market growth. The benefits that can originate from the EU NMs market, especially in the medicine, energy, and electronics fields, cannot be overlooked.

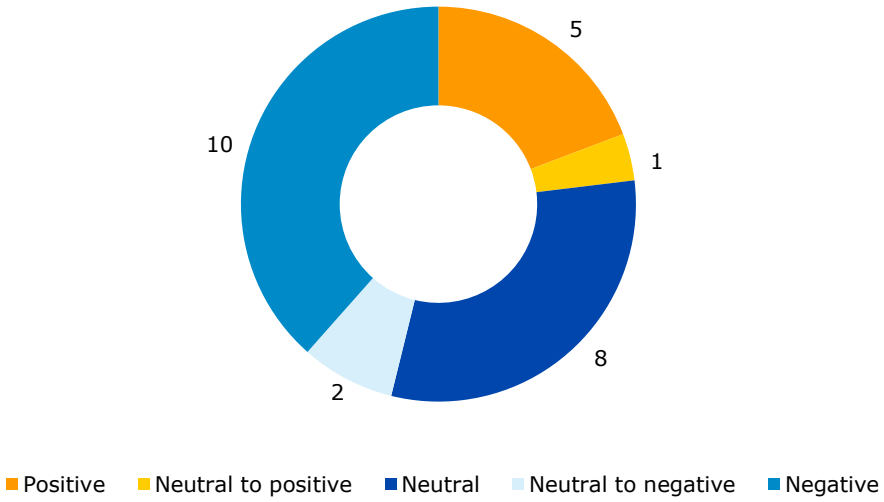

Figure 34. Do you consider the public perception of nanomaterials and nanomaterial containing products as positive, neutral, or negative?

6. Market projection of the EU NMs market

In this section, we present the 5-year (up to 2026) market projections of the EU NMs market, as well as per NM segment. The segments presented are:

- Metals
- Metal oxides
- Carbon-based NMs
- Dendrimers
- Nanoclays
- Nanocellulose

The projections are based on actual data and estimations of the available NMs volumes and NMs market worth, i.e., peer-reviewed publications, non-peer-reviewed publications, governmental reports, industrial annual reports, commercial reports etc. The retrieved data were complemented with information gathered from the online survey, the focus groups, and personal interviews.

6.1 Current assumptions

The assumptions within the presented market projections include that the identified volumes are the actual, although some deviation is expected due to the increased number of SMEs and start-ups, the production volumes of which are hard to identify. Other assumptions include the conversion of currency data from US dollar (USD, $) to Euros (EUR, €). This took place for the historical data. For this reason, the respective annual average rate of USD to EUR was used. Finally, identified historical volumes and revenue have been adjusted to take Brexit into account and perform the projections for the EU, EEA, and Switzerland. Hence, the projections presented here do not take the UK into account.

In general, no significant collapse or recession of the EU NMs is foreseen within the next 5 years. This assumption is because the collected data via the surveys and interviews demonstrated that the SARS-COV-2 pandemic had no or minimal effect in the NMs market. For metallic and carbon-based NMs, it was reported that the EU NMs market increased during the pandemic period. This was attributed to market operators being able to focus on product development or improvement, as R&D continued at a commercial level. On the other hand, the halting of academic-related research, due to the pandemic and resulting lockdowns, is not considered to have a substantial negative effect to the overall EU NMs market. Furthermore, construction, manufacturing, and medicine – the key segments of NMs usage – did not stop operation during the pandemic. On the contrary, NMs usage may have been boosted due to the increased need for personal protective equipment (PPE) and office supplies for protecting and separating employees. This has been mirrored during our search of NMs suppliers, presented in section 3.1, as in several cases PPE and glass/plastic office NM-containing products were offered. On the other hand, commercial reports [4] report substantial effects of the coatings, paints, and adhesives industries, which constitutes the largest commercial EU NMs market segment (18.8%, section 3.1). This was attributed to factories closure, halting of constructions and disruption in the supply chain. While some effect was to be expected, this has not been substantial so as to slow down the market.

Brexit does not seemto have affected the EU NMs market significantly, despite the disruptions in the supply chain, as the UK has not yet imposed border controls on products entering its territory [118], which are expected to be phased in from 2022 giving EU companies plenty of time to prepare. When introduced, some reduction is to be expected, but this will probably affect smaller providers, with low market share, as major players have most likely separate entities within the two markets already. Within the EU, on the other hand, the introduction of full border controls since 1 January 2021 is expected to have led to a boost of the internal EU NMs market, as buyers' demand is expected to shift to EU-based operators, reducing the risk of red-tape and delays in delivery. This shift will further be boosted in case the UK's regulatory regime for NMs (and advanced and complex materials) deviates from the EU towards a more de-regulated environment. In any case, the major market operators will most likely be "immune" to such changes as mentioned earlier.

During the calculation of the market projections, we calculated the average UK market share for the period between 2016 – 2020 and subtracted it from the retrieved data to estimate the historical EU, EEA and Swiss NMs market value and volumes. As we used an average value instead of precise percentages, some uncertainty is expected to be introduced in the presented results.

6.2 Porter's five forces – EU NMs market strategic landscape estimate

To further understand the market, we present Porter's five forces for the NMs market (Figure 35), which include:

- Industry competition

- Potential of new entrants
- Power of suppliers
- Power of customers
- Threat of substitution

These forces shape the industry, and the market, help identify its structure and determine the strengths and weaknesses [119]. We must note here that while we believe the analysis on the 5 forces presented below is currently valid, continued monitoring and updating is required, considering the fluid, and changing environment of the EU market.

6.2.1 Industry competition

Industry rivalry refers to the size of the market and the ability of specific players to undercut their competitors and gain strategic advantage. Theoretically, the higher the number of players in a market the less the power of individual players, due to the higher supply compared to specific demand. In the case of the NMs market, there is a substantial number of suppliers in all segments. As stated, though, during the surveys and interviews and demonstrated through the operators screening (section 3.1), the majority of the NM producers are SMEs and start-ups with specific major players dominating the market. As a result, rivalry within the market is considered very high, especially when importers from other markets like the US and Asia are considered. The rivalry is mainly observed within the major players, as the smaller are very much fragmented and not in a strong position to support regulatory requirements and scaling up costs to compete with the bigger players. As Inkwood Research also states [4], R&D plays a key role on maintaining competitive advantage, something the major players can do. On the one hand, this can lead to more novel NMs reaching the market, but on the other hand inhibits smaller players from increasing. Thus, the high industry rivalry can be mainly traced within the big multinational players of the NMs market. The formation of consortia between the smaller players to address the issues they face may lead to increased market rivalry and costs reductions.

6.2.2 Potential of new entrants

The threat of new entrants within a market is considered taking into account also the costs required to enter a market and be an effective competitor [119]. In this case, the potential of new entrants is considered moderate due to the investment costs required to enter the market. This is based on the stricter regulatory environment compared to other markets and the need to introduce novel NMs with improved properties to compete with the existing major players and customer loyalty. Considering new entrants based in the EU, this would mean increased costs in R&D and establishing and scaling up a robust and reliable manufacturing chain. From external markets, the regulatory cost for registering, importing products, and establishing a sustainable distribution chain, at substantial volumes to be considered as threats to the established major players, are considered relatively high.

6.2.3 Power of suppliers

The power of suppliers refers to the ability of suppliers to drive up the costs required to create and maintain a product or service and the easiness with which customers can switch suppliers. The higher the number of suppliers or the lower the switching suppliers costs the lower the power of suppliers to regulate these and control the market. In the case of the EU NMs market, the power of suppliers is considered high, due to the existence of a set of major players having high market concentration and very robust and reliable supply chains [4]. While there are many new products coming into the market and an increasing number of NMs users, the costs of investment to develop scaled up manufacturing units and distribution chains is a limiting factor to increasing competition and reducing suppliers' power.

6.2.4 Power of customers

The power of customers refers to the ability of customers to drive prices lower and negotiate better deals. It is strongly correlated to each of the companies' client-base, their significance, and the cost to attract and retain new customers. For the EU market, this can be analysed in two ways. Firstly, considering customers of NMs suppliers to produce NM-containing products and secondly, the EU consumer market. In both cases, the customer base is expanding. In the first instance, the presence of a small number of major suppliers, limits the power to negotiate lower prices, although this can be offset by the need for better offerings to attract and retain new clients, especially in the case of start-ups and SMEs. For the consumer market, the increasing number of NM-containing products, the need for such products (e.g., medicines, cosmetics and personal care, paints, wearables), and the effects of the pandemic on the buying power of households means that providers need to offer better deals, although this is probably segment specific (e.g., medicine vs. cosmetics). Additionally, the more negative public opinion of consumers towards NMs, as also expressed during the interviews, forces suppliers to offer better deals to expand their market share. Therefore, the power of customers in the EU market is considered moderate.

6.2.5 Threat of substitution

In in the EU market the threat of substitution of NMs with other types of materials is considered low. The costs associated with the development and bringing NMs into the market over the years means that most suppliers would be reluctant, to say the least, to drop these and turn to other solutions that could require an equal amount of costs in R&D and manufacturing. While such an idea was suggested during the interviews, due to the current NM regulatory landscape and the difficulties in registering NMs, for carbon-based NMs to be substituted by polymer solutions, the potential revision of regulatory requirements for polymers, expected to be phased in by the end of 2022 [120], makes this idea unlikely. Although there is a high likelihood that such a move would be very segment-specific, during the metals and metal oxides interviews the idea of substitutes, at least within the next 5 years, was dismissed as unrealistic and financially disadvantageous.

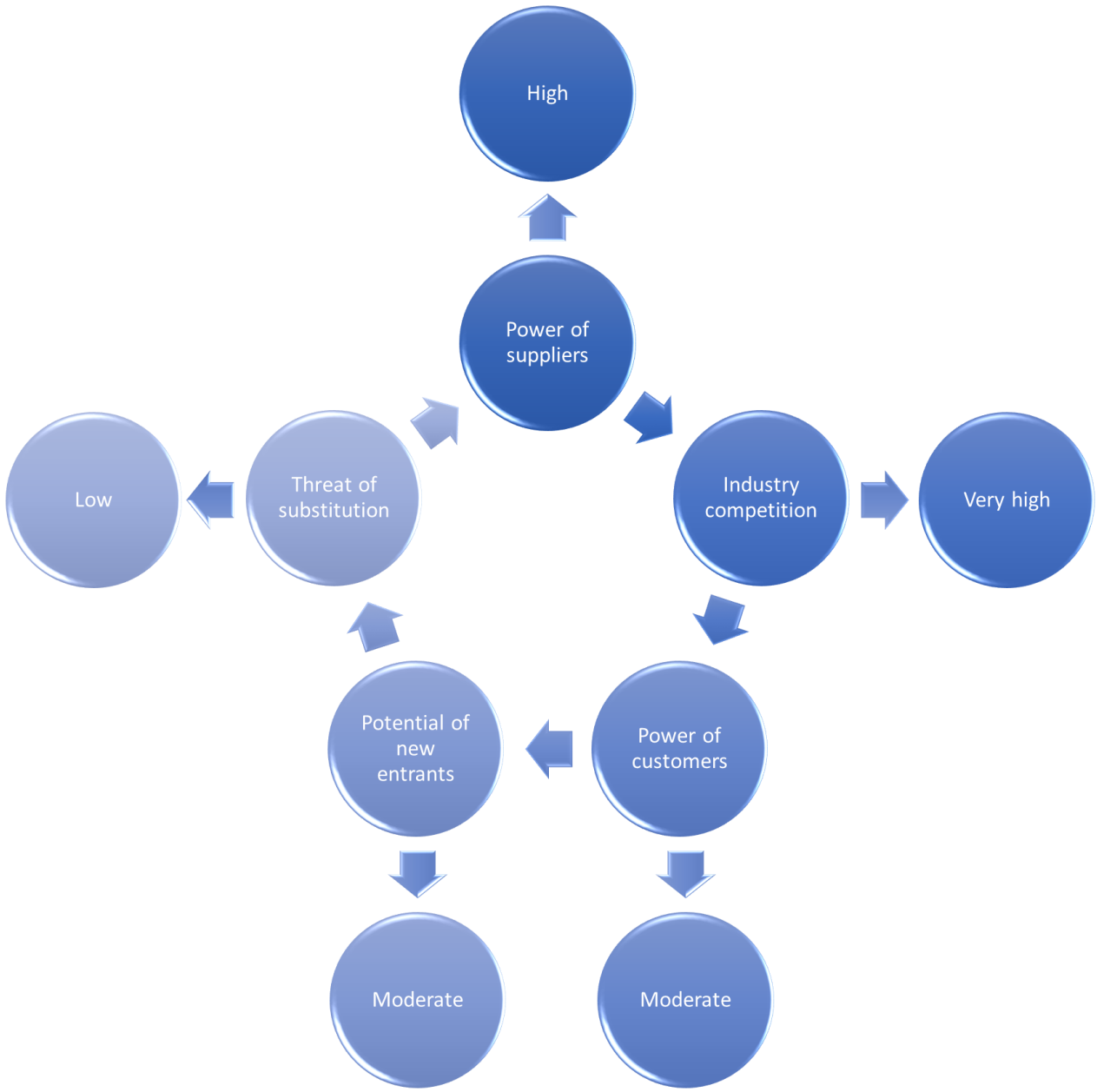

Figure 35. Porter's five forces for the current state of the EU, EEA, and Switzerland NMs market.

6.3 Market projections

In this section, we present the 5-year market projections for the EU NMs market. The projections are based on a combination of retrieved numerical data, allowing a quantitative analysis and the survey and interview responses, which provided a qualitative expert estimation. The results presented, in terms of future projections, are the result of both quantitative (i.e., percentage changes) and qualitative (i.e., driving forces, bottlenecks) analysis.

6.3.1 The EU NMs market

The Europe's average global market share was estimated to be around 19.7% in 2016 [11], [29]. The EU NMs market size was estimated to be 2.9 €billion, with a total volume of 70.8 Kilotons [3], [4], [9], [29]. This reached an estimated 5,205 €million and 140.9 Kilotons by 2020

[4], which translates to an average compound annual growth rate (CAGR) of 16% and 18.8%, respectively. These figures fall closer to the conservative scenario (15.5% CAGR) rather than the optimistic (20.7%) scenario for the NMs market value as presented by Inshakova et al. (2017) [29]. During this period, the UK NMs market share, was estimated to be between 10.4% in 2016 and 10.7% in 2020 [4], with an average market share of 10.55%. Subtracting the UK participation, the EU, EEA, and Swiss market increased from 2,568 €million and 63.3 Kilotons in 2016 to 5,198 €million and 141 Kilotons in 2020 (Figure 36).

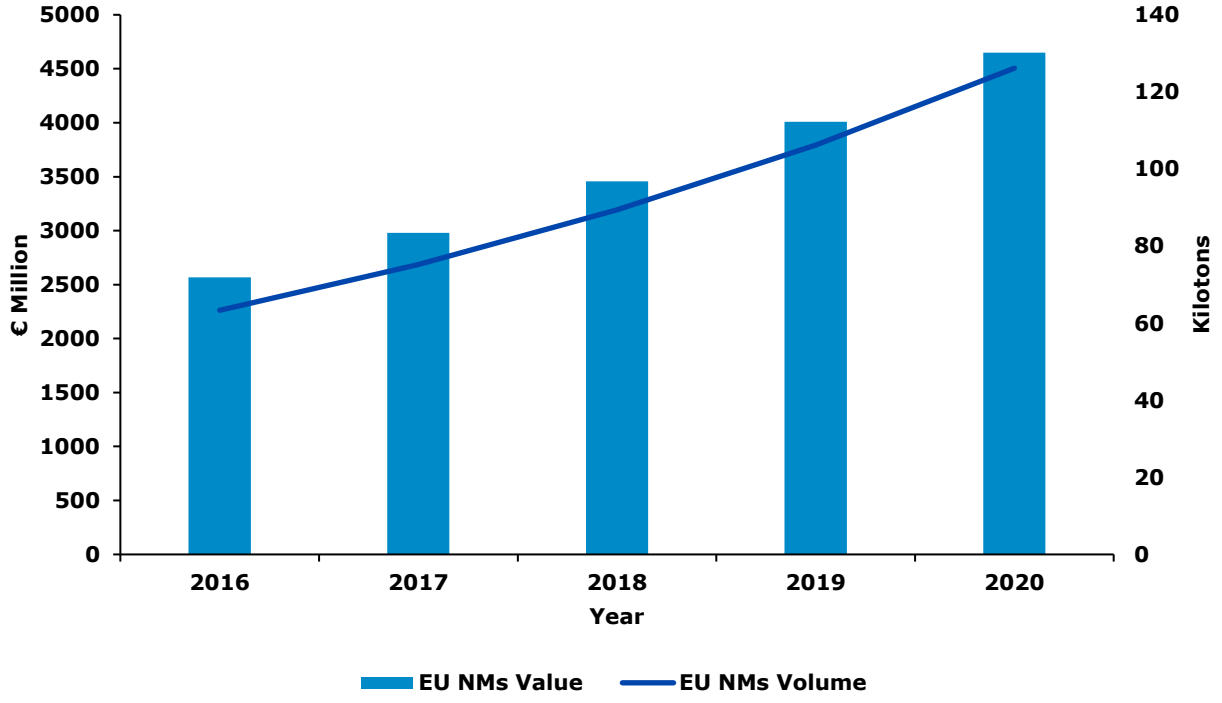

Figure 36. EU NMs market evolution between the years 2016 and 2020.

Considering the different NM segments (Figures 37 and 38) and based on retrieved data [3], [4], [9], the biggest NM segment on the EU market are currently metal oxides with a market share of 88.4% per volume and 75.7% per value. Considering volumes, metal oxides are followed by nanoclays (10.6%), carbon-based NMs (0.5%), nanocellulose (0.2%), metals (0.1%) and dendrimers (0.4%). Per value, metal oxides are followed by the carbon-based NMs (14.3%), metals (8.2%), nanoclays (1.2%), nanocellulose (0.5%) and dendrimers (0.1%). These results agree with Porter's 5 forces, as excluding the dominating metal oxides segment, carbon-based NMs demonstrate their dynamic and value as they have substantially more revenue compared to the rest of the segments although this is not translated equally in volumes. This suggests that, currently, the power of suppliers is high driving costs up, but at the same time this translates into high investment in R&D for the development of novel carbon-based NMs, i.e., CNTs, graphene, fullerenes etc.

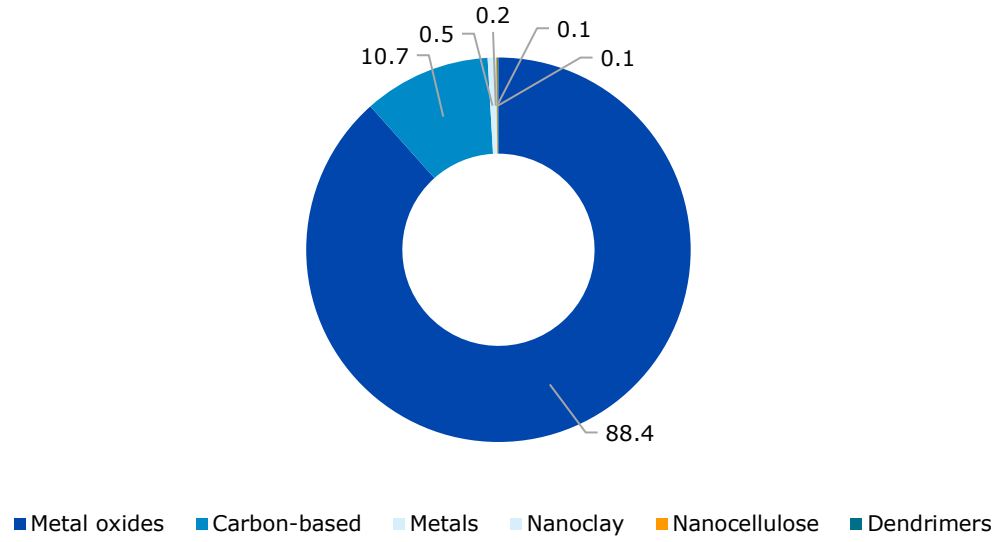

Figure 37. EU NMs % market segmentation per NM type per volume in 2020.

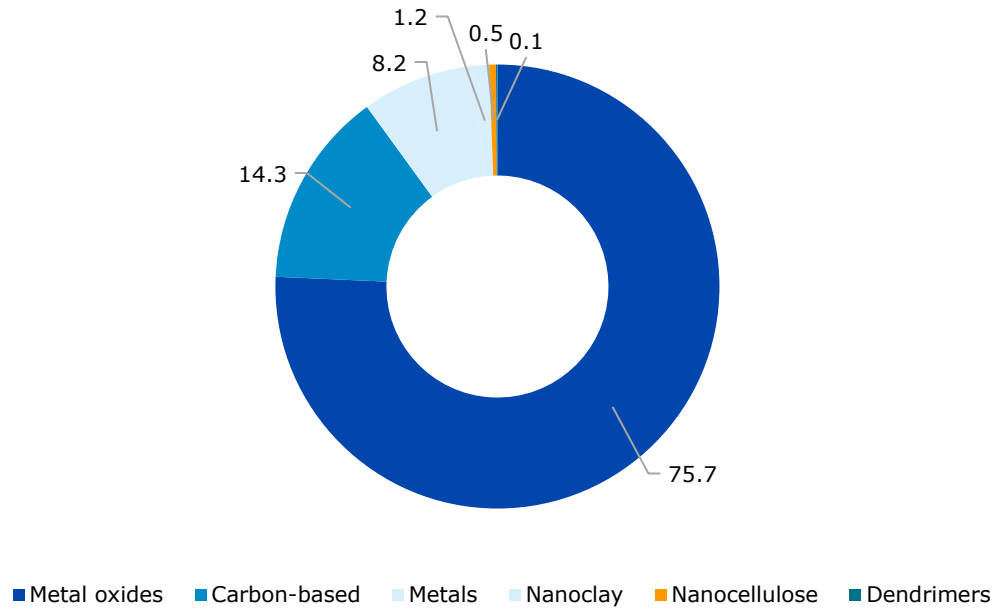

Figure 38. EU NMs % market segmentation per NM type per value in 2020.

Based on these results, Table 2 presents the market share per volume and value for each NMs type in 2020.

TABLE 2: VOLUMES AND VALUE IN 2020 PER NMS SEGMENT.

NMs Type	Volume (Kilotons)	Value (€million)
Metal oxides	124.6	3943
Carbon-based	0.8	743
Metals	0.1	429
Nanoclay	15	64
Nanocellulose	0.3	25
Dendrimers	0.1	1

To identify the growth of the NMs market over the next five years, we need to calculate the estimated CAGR for this period. This estimation has been based on data retrieved from publications and from the surveys and interviews. In all cases, a positive trend is expected for all market segments.

6.3.2 Metal oxide NMs projections

In the case of metal oxides, most of the expert predicted a market increase of around 50% over the next 5 years. This translates to a final volume of 186.9 Kilotons and a CAGR of 10.7%. Based on data retrieved the estimated CAGR for metal oxides is between 7% and 15.53% [4], [9]. Based on these results we estimate a CAGR of 10.9% for the metal oxides NMs market as our basic scenario, with 7% CAGR being the conservative prediction and 15.53% the optimistic. As a result, the market size of the metal oxides NMs market is presented in Table 3 and Figure 39.

TABLE 3: FIVE-YEAR METAL OXIDE NMS PREDICTIONS PER VOLUME.

Year	Conservative Scenario (7% CAGR)	Basic Scenario (10.9% CAGR)	Optimistic Scenario (15.53% CAGR)
2020	124.6	124.6	124.6
2021	133.3	138.2	143.9
2022	142.7	153.2	166.3

2023	152.6	169.9	192.1
2024	163.3	188.5	222.0
2025	174.8	209.0	256.4

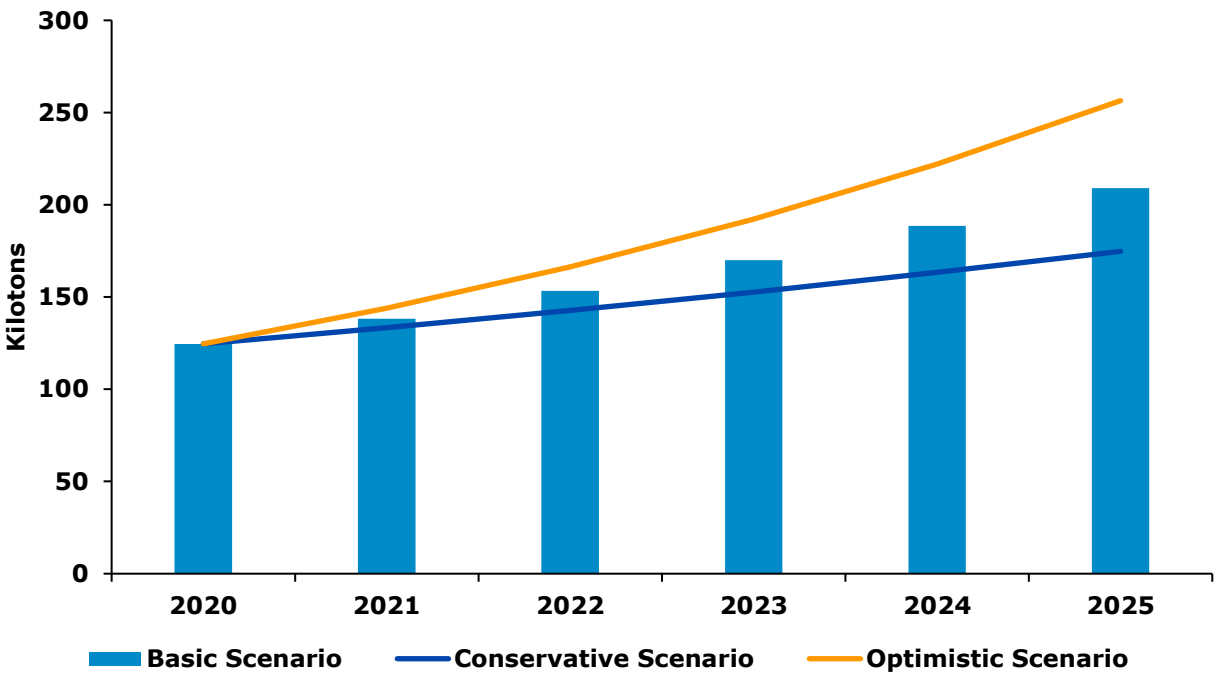

Figure 39. Prediction of the size of the EU NMs metal oxide market per volume for the period 2021 – 2025.

A similar trend is project for the metal oxides market value, which is projected to increase by 15.25% CAGR [4], which is again the optimistic scenario. For the basic scenario we predict an increase of 10.5% CAGR and 6.86% CAGR for the conservative. The results are presented in Table 4 and Figure 40.

TABLE 4: FIVE-YEAR METAL OXIDE NMS PREDICTIONS PER VALUE.

Year	Conservative Scenario (6.86% CAGR)	Basic Scenario (10.5% CAGR)	Optimistic Scenario (15.25% CAGR)
2020	3,943	3,943	3,943
2021	4,213	4,357	4,544
2022	4,503	4,815	5,237

2023	4,811	5,320	6,036
2024	5,141	5,879	6,956
2025	5,494	6,496	8,017

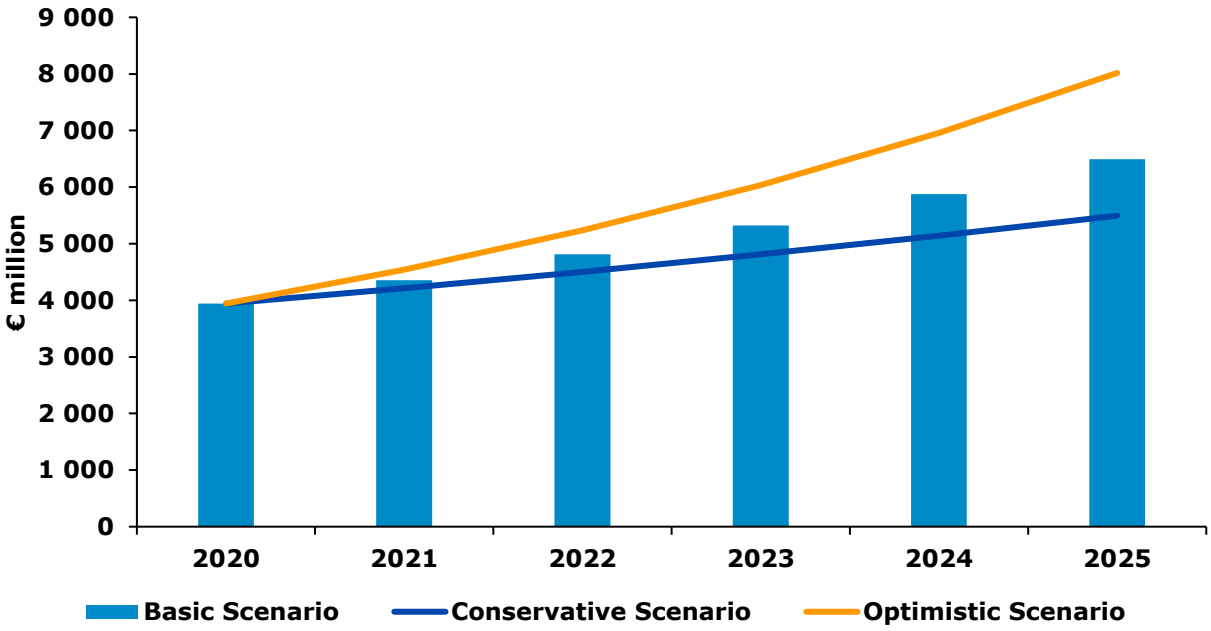

Figure 40. Prediction of the size of the EU NMs metal oxide market per value for the period 2021 – 2025.

The predicted growth is expected to be driven by the manufacturing and industrial sectors. Metal oxides, as mentioned in section 3.2.1 are used in several technological applications such as the fabrication of circuits, electronics and more. They are also used in energy as additives in solar cells. In construction metal oxides are heavily used as additives in paints and surface to prevent corrosion and dirt. Specific oxides, like TiO_2 and ZnO, are also being used in glasses, both in construction and consumer products, as UV filters, the absorption wavelength of which can be modified using dopants. Substantial use exists for metal oxides in medicine as iron oxide NMs are being used in imaging.

Uncertainties with respect to the metal oxide NMs market have to do with the changing regulatory landscape. Any changes, towards stricter regulation as suggested by certain EU countries, can slow down the market. On the other hand, a new wave of SARS-COV-2 that may result in lockdowns and construction halting, will also have a negative effect, although this is not expected to happen considering the ongoing vaccination programs and the medicines, which are in the pipeline and expected to reach the market shortly. The extensive use of metal oxides and the focus they attract from the big players, means that there are already robust manufacturing lines pushing down the cost of production boosting the market. Furthermore, public funding towards novel complex and advanced materials, will also push the market forward, in the long-term, via the development of novel doped metal oxides. This, though, is not expected to happen extensively in the next 5 years, as was also suggested during the interviews.

It must be noted here, that the SASFORREACH Consortium GbR (https://www.reach-sas.org) states that the registration dossier for synthetic amorphous silica (SAS) covers both, nanoform(s) and non-nanoform(s) of SAS. Members of the SASFORREACH Consortium GbR, however, have only knowledge about nanostructured SAS (https://www.reach-sas.org/faq.htm#x:3_4). If this is the case, then the presented results would change significantly as the amount of SiO_2 in the EU, EEA, and Swiss market would be mostly, if not entirely, nanostructured. These results were not possible to be verified by other sources and commercial reports. Furthermore, the silica reported in the case of SASFORREACH Consortium GbR is a "nano-structured material" according to ISO TC 229, consisting of aggregates and agglomerates. ISO TC 229 (https://www.iso.org/committee/381983.html), though, deals with "matter and processes at the nanoscale, typically, but not exclusively, below 100 nanometres in one or more dimensions where the onset of size-dependent phenomena usually enables novel applications". This means that a portion of the silica reported under the SASFORREACH consortium could be outside the EC definition for NMs, while producers who are not members of the SASFORREACH Consortium GbR could very well produce bulk silica. This is reflected in the SASFORREACH Consortium's GbR website Frequently Asked Questions (https://www.reach-sas.org/faq.htm), where specific guidance for producers of bulk silica is offered.

6.3.3 Metals NMs projections

Metal NMs are expected to grow with a CAGR 15% and 17.9% [4], [9], [107] per volume, while in the expert surveys and interviews case, the results were similar to the metal oxides. As a result, as a basic scenario we expect the metal NMs market to grow with a CAGR of 14.9%, with a conservative scenario of 11% CAGR and an optimistic scenario of 17.9% CAGR. Per value, the metal NMs market is expected to grow by 15.49% CAGR [4], which is considered to be the optimistic scenario, with the basic and conservative being similar to the volumes one. Hence the results for 5-year projection the metal NMs market per volume and value are presented in Table 5 and Figure 41 and Table 6 and Figure 42 respectively.

TABLE 5: FIVE-YEAR METAL NMS PREDICTIONS PER VOLUME.

Year	Conservative Scenario (11% CAGR)	Basic Scenario (14.9% CAGR)	Optimistic Scenario (17.8% CAGR)
2020	0.14	0.14	0.14
2021	0.16	0.16	0.17
2022	0.17	0.18	0.19
2023	0.19	0.21	0.23
2024	0.21	0.24	0.27
2025	0.24	0.28	0.32

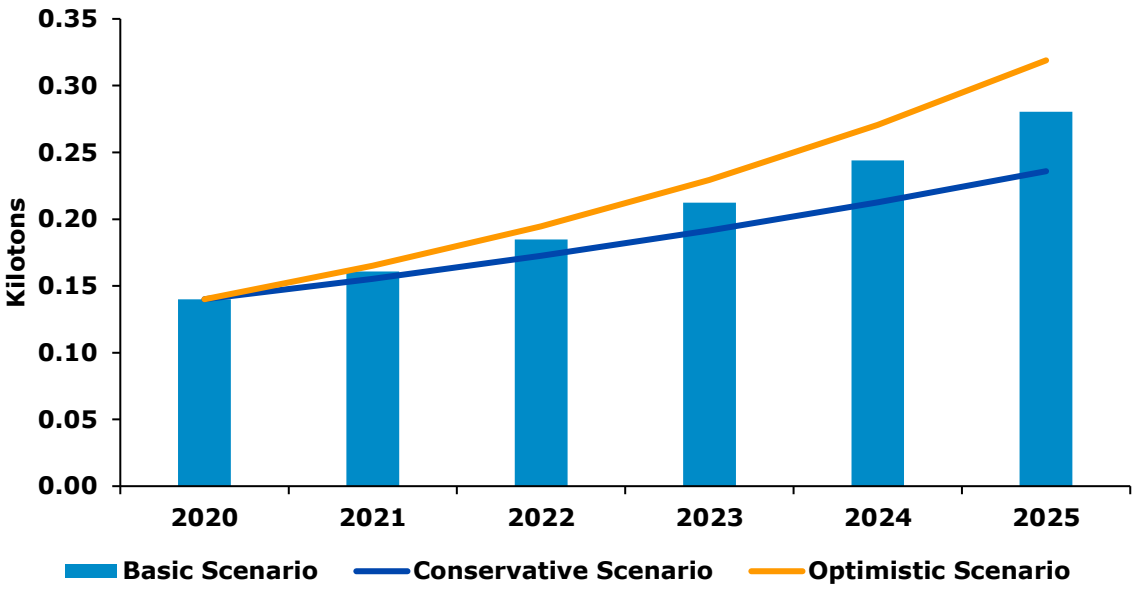

Figure 41. Prediction of the size of the EU metal NMs per volume for the period 2021 – 2025.

TABLE 6: FIVE-YEAR METAL NMS PREDICTIONS PER VALUE.

Year	Conservative Scenario (11% CAGR)	Basic Scenario (14.5% CAGR)	Optimistic Scenario (15.49% CAGR)
2020	535.54	535.54	535.54
2021	594.45	613.19	618.50
2022	659.84	702.11	714.30
2023	732.42	803.91	824.95
2024	812.99	920.48	952.73
2025	902.42	1053.95	1100.31

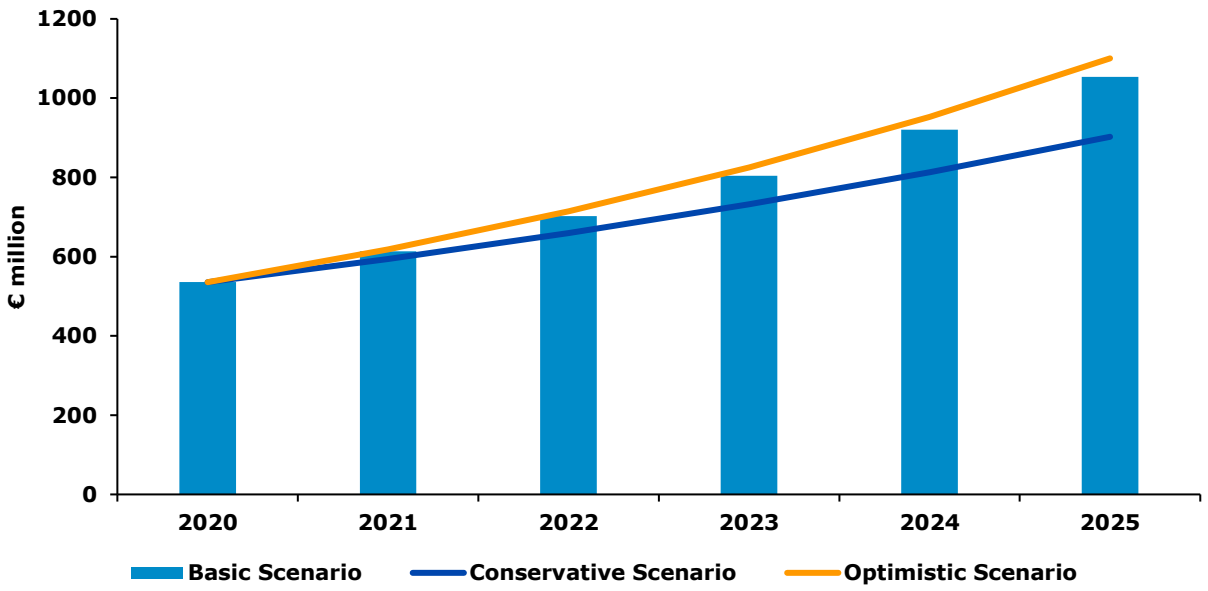

Figure 42. Prediction of the size of the EU metal NMs per value for the period 2021 – 2025.

Metal NMs involve the use of single metals like Ag, Au, Ni, quantum dots, as well as alloys of two or more metals. Such NMs have extended use in electronics, energy, (3D) printers and inks, and construction. They are used in medicine and cosmetics (due to their antibacterial and other properties) as well, although concerns exist regarding their use. The substantial increase in demand for NMs in all the above sectors will drive growth, especially in the case of the NMs used in the energy and electronics sectors and medicine. This will also lead to even better manufacturing facilities and distribution lines, which will drive production costs down.

6.3.4 Carbon-based NMs projections

Carbon-based NMs include CNTs, graphene and fullerenes. In all these categories substantial growth is expected by both the retrieved data and interviews, mirroring the potential due to their unique properties. It is expected to be the fastest growing segment, which is evident by the number of carbon-based manufacturers identified in the form of start-ups and SMEs. Europe held the largest market share globally in 2019 (42%), due to support for the EU and local governments [121].

6.3.4.1 Carbon nanotubes

For CNTs the reported produced volume for 2020 is 0.79 Kilotons, valued at 452.47 €million. During the expert surveys and interviews, it was suggested that the market would grow with a CAGR of 120% for the next 5 years, due to an explosive market based on perspective and impactful solutions for an extensive variety of industries. We will consider this as the optimistic scenario. The reported CAGR per volume for CNTs in retrieved data ranged between 14.4% - 33.3% [4], [9], [121]–[124]. Based on the retrieved data, our basic scenario is the CAGR for the EU CNT market will be 19.26%, with the conservative scenario being a CAGR of 14.4% (Table 7, Figure 43). Per value the predictive values are 14% CAGR, 18.8% and 100% for the conservative, basic and optimistic scenario (Table 8, Figure 44).

TABLE 7: FIVE-YEAR CNTS PREDICTIONS PER VOLUME.			
Year	**Conservative Scenario (14.4% CAGR)**	**Basic Scenario (19.26% CAGR)**	**Optimistic Scenario (120% CAGR)**
2020	0.79	0.79	0.79
2021	0.90	0.94	1.74
2022	1.03	1.12	3.82
2023	1.18	1.34	8.41
2024	1.35	1.60	18.51
2025	1.55	1.91	40.71

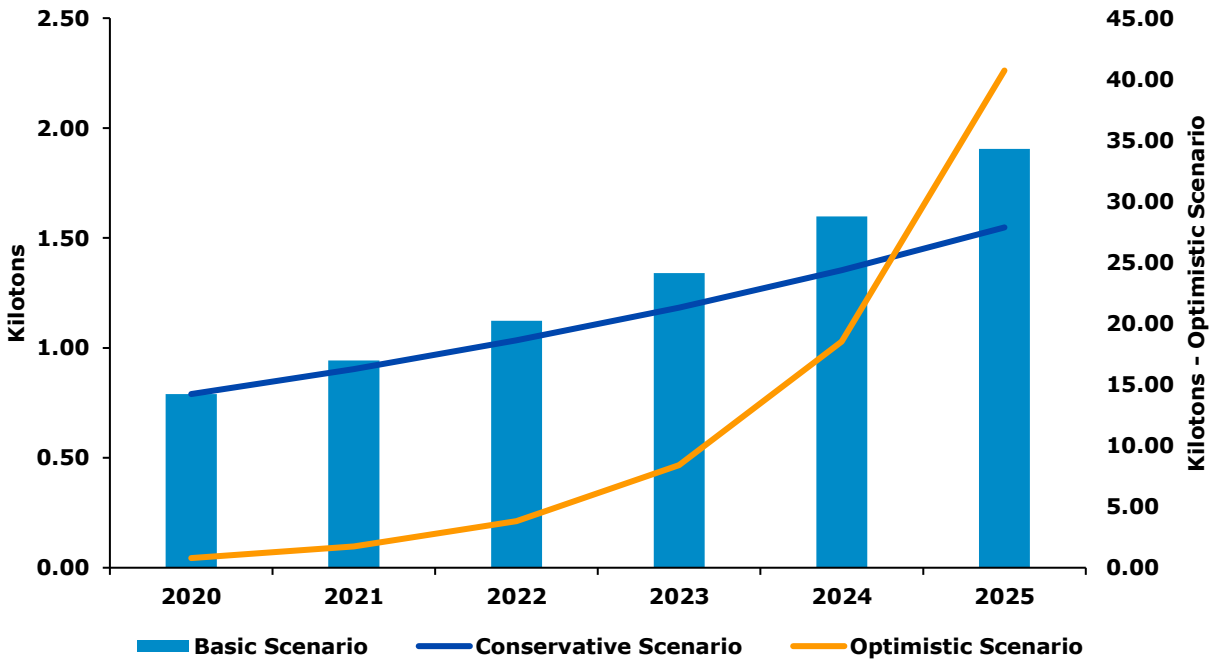

Figure 43. Prediction of the size of the EU CNTs per volume for the period 2021 – 2025.

TABLE 8: FIVE-YEAR METAL NMS PREDICTIONS PER VALUE.			
Year	**Conservative Scenario (14% CAGR)**	**Basic Scenario (18.8% CAGR)**	**Optimistic Scenario (100% CAGR)**
2020	452.47	452.47	452.47
2021	515.82	537.53	904.94
2022	588.03	638.59	1,809.88
2023	670.35	758.65	3,619.76
2024	764.20	901.27	7,239.52
2025	871.19	1,070.71	14,479.04

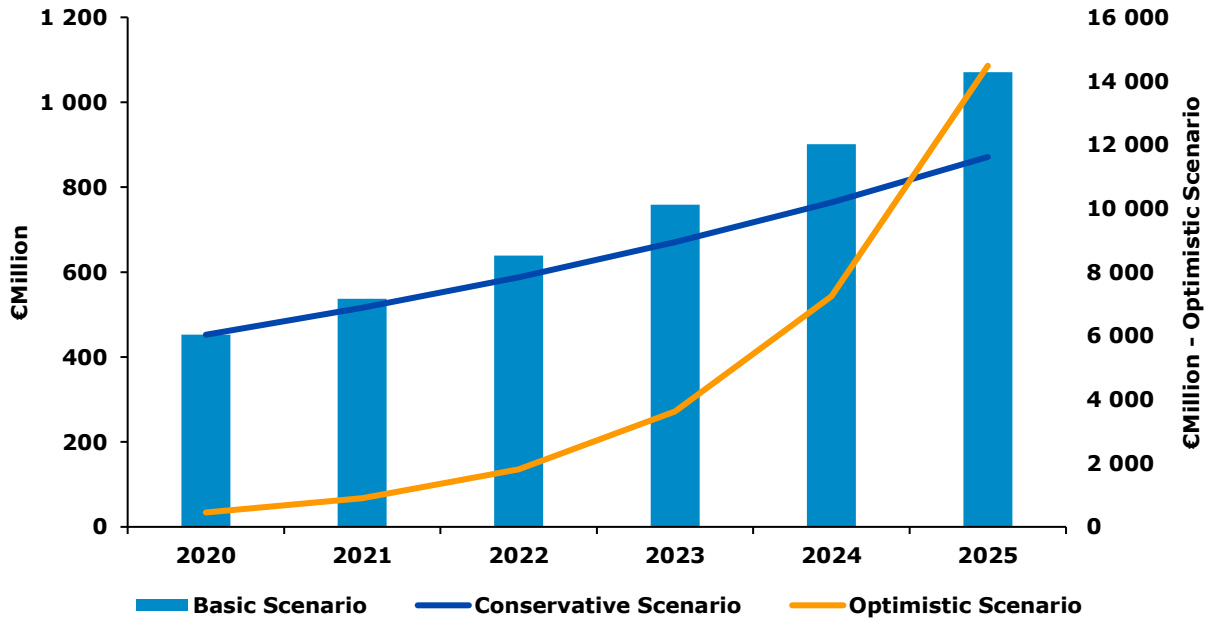

Figure 44. Prediction of the size of the EU CNTs NMs per value for the period 2021 – 2025.

CNTs are the currently most popular carbon-based NMs, due to their superior properties such as high thermal and electric conductivity, elasticity, tensile strength, flexibility, electron field emitter, and low thermal expansion coefficient making them ideal for the energy, manufacturing, and construction sectors [121]. CNTs are also studied for use in medical applications, due to their high surface area, excellent chemical stability, and rich electronic polyaromatic structure,

which allows their functionalisation with a wide range of drugs, proteins, antibodies, DNA, and enzymes. As a result, there is increasing demand for CNTs on the EU market, boosted by the public funding either via European or National programs, the applications in the automobile and aerospace industries to decrease reliance in aluminium and decrease engine weight and produce batteries with better functionality. In the medicine sector, CNTs extensive research is being performed especially in the fields of cancer, diabetes, pain, asthma, allergy, and infections.

The main barrier of growth for the CNTs NMs market is the concern regarding their potential health hazards, combined with manufacturing methods. CNTs have the tendency to coagulate when added into complex environments. To compensate for this, several manufacturers treat the surface of CNTs with carbon black, which can have adverse effects on human health. The length of CNTs is also an issue, as longer CNTs have been demonstrated to enter human tissues leading to substantial health issues [4], [121].

6.3.4.2 Graphene

The graphene market is probably the most active between all the NM segments [125]. There has been huge investment, of 1 €billion, by the EU in the Graphene Flagship program to achieve graphene commercialisation [60]. As a result, currently the EU market is the biggest globally, but other markets are catching up, with the more regulatory lenient Asia-Pacific region to be the most dynamic [9], [126], [127], with China considered to be the next biggest player due to low regulation, huge state support and investment, increasing technological advancement and more NMs-friendly market [126], [127], something also pointed out during the interviews.

The size of the EU graphene market in 2020 was reported to be around 0.04 Kilotons per volume [4], in close agreement with the performed interviews, with a value of 92.8 €million [4], [127]. The reported CAGR is relatively high ranging between 18,55% - 43% [4], [126], [128], [129], with reports during the interviews taking it up to 69.9% and 216.2 CAGR per volume and 111.4% CAGR per value. Based on these results, our basic scenario estimates a CAGR of 38.3% per volume and 33.1% per value. The conservative scenario is 33% and 30.2% per value. The optimistic is 60.6% per volume and 44.3% per value. The results are presented in Tables 9 and 10 and Figures 45 and 46.

TABLE 9: FIVE-YEAR GRAPHENE PREDICTIONS PER VOLUME.

Year	Conservative Scenario (33% CAGR)	Basic Scenario (38.3% CAGR)	Optimistic Scenario (60.6% CAGR)
2020	0.04	0.04	0.04
2021	0.05	0.06	0.06
2022	0.07	0.08	0.10
2023	0.09	0.11	0.17
2024	0.13	0.15	0.27
2025	0.17	0.20	0.43

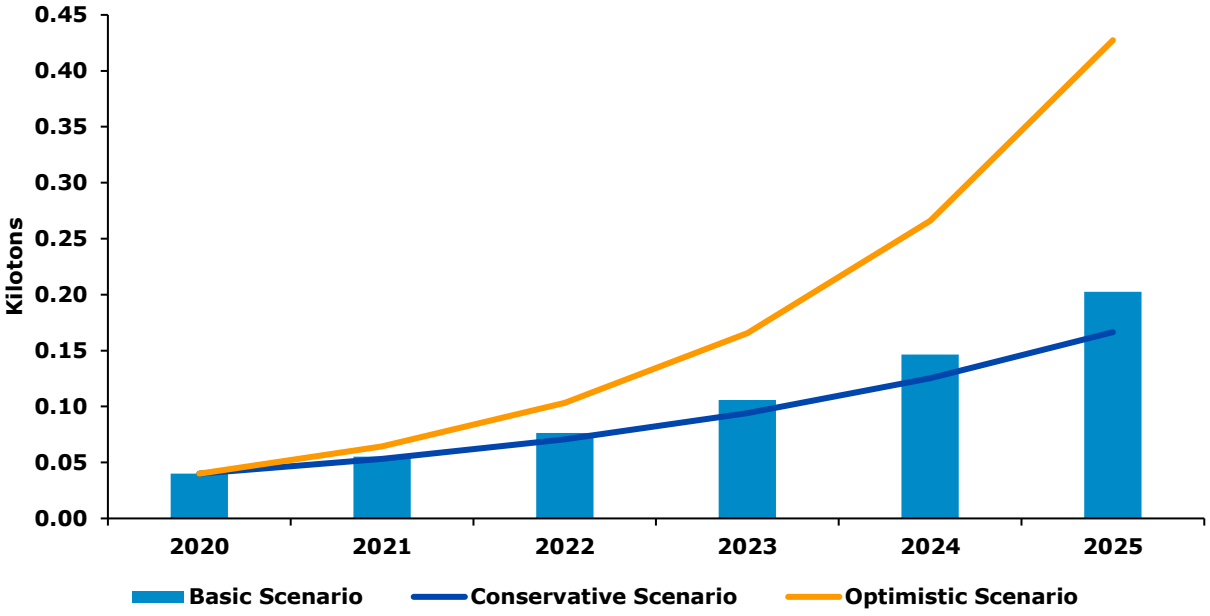

Figure 45. Prediction of the size of the EU graphene market per volume for the period 2021 – 2025.

TABLE 10: FIVE-YEAR METAL NMS PREDICTIONS PER VALUE.

Year	Conservative Scenario (30.2% CAGR)	Basic Scenario (33.1% CAGR)	Optimistic Scenario (44.3% CAGR)
2020	92.80	92.80	92.80
2021	120.83	123.52	133.91
2022	157.31	164.40	193.23
2023	204.82	218.82	278.83
2024	266.68	291.25	402.36
2025	347.22	387.65	580.60

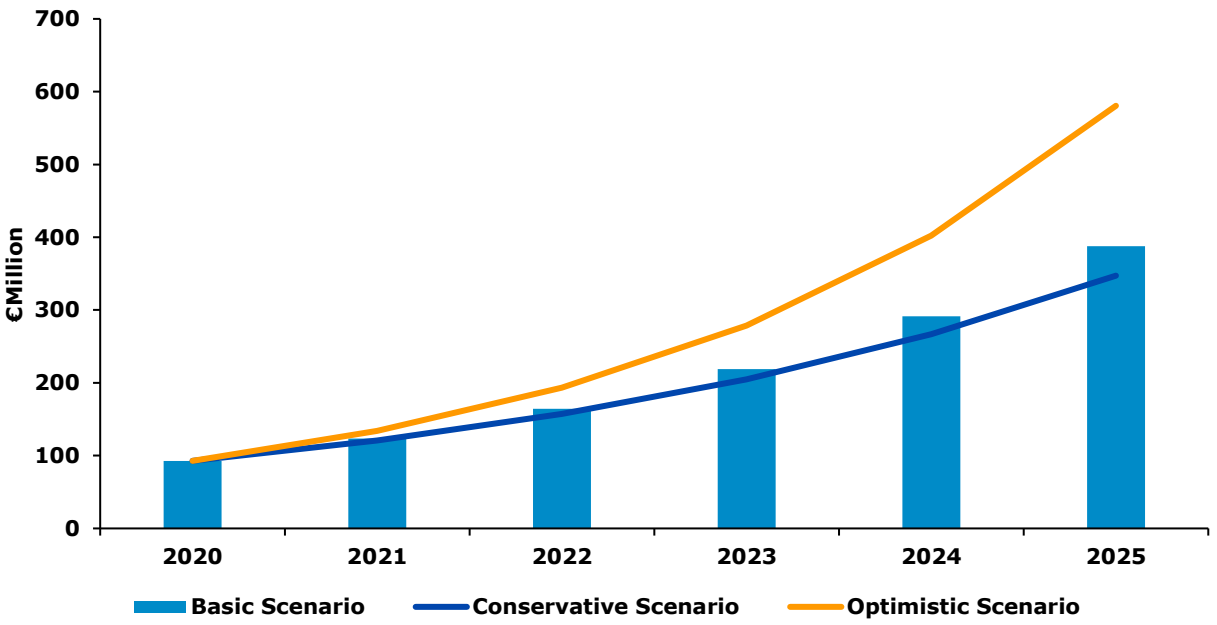

Figure 46. Prediction of the size of the EU graphene market per value for the period 2021 – 2025.

6.3.4.3 Fullerenes

The fullerenes market is also expected to present strong growth in the EU, although the data retrieved were limited. Reported CAGR per volume and value have been reported to be 17.74% and 15.55%, respectively [4], while during the interviews a 100% rise in 5 years was suggested, which corresponds to a CAGR of and 18.9%. Based on these our basic scenario predicts a CAGR of 18.32% 17.23% per volume and value, respectively. The conservative estimation is 17.74% and 15.55% per volume and value, respectively. The optimistic scenario is 18.9% CAGR. The results are presented Tables 11 and 12 and Figures 47 and 48, respectively.

TABLE 11: FIVE-YEAR EU FULLERENES NM MARKET PREDICTIONS PER VOLUME.

Year	Conservative Scenario (17.74% CAGR)	Basic Scenario (18.32% CAGR)	Optimistic Scenario (18.9% CAGR)
2020	0.02	0.02	0.02
2021	0.02	0.02	0.02
2022	0.03	0.03	0.03
2023	0.03	0.03	0.03

2024	0.04	0.04	0.04
2025	0.04	0.05	0.05

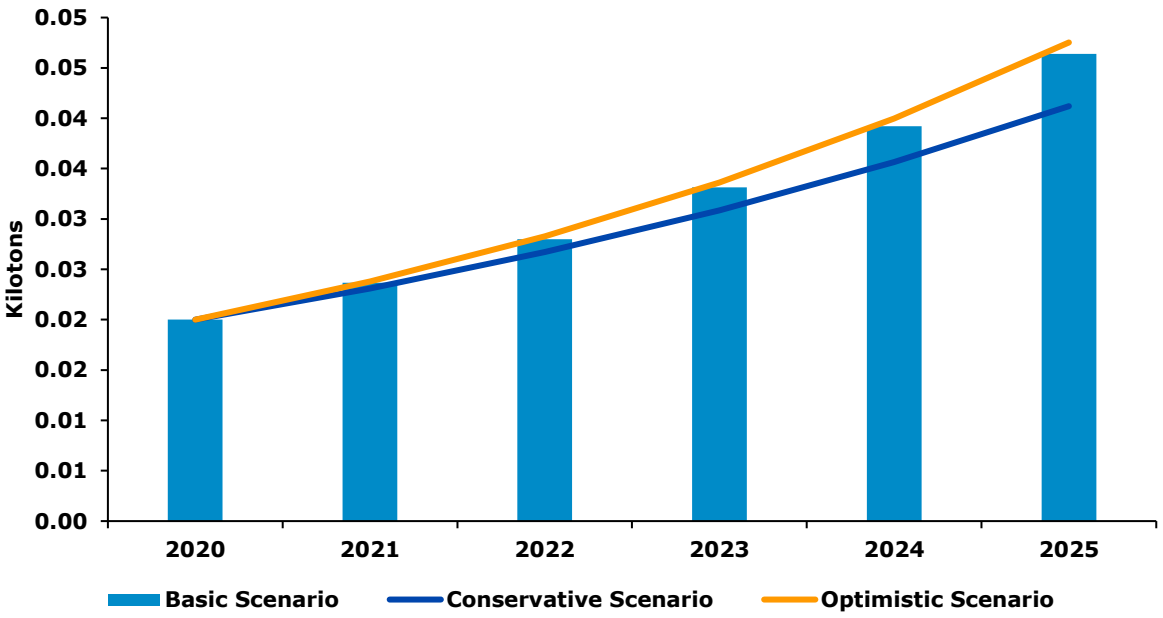

Figure 47. Prediction of the size of the EU fullerenes market per volume for the period 2021 – 2025.

TABLE 12: FIVE-YEAR EU FULLERENES NMS MARKET PREDICTIONS PER VALUE.

Year	Conservative Scenario (15.55% CAGR)	Basic Scenario (17.23% CAGR)	Optimistic Scenario (18.9% CAGR)
2020	470.70	470.70	470.70
2021	554.20	551.80	559.66
2022	652.52	646.88	665.44
2023	768.27	758.33	791.21
2024	904.57	888.99	940.74
2025	1,065.04	1,042.17	1,118.55

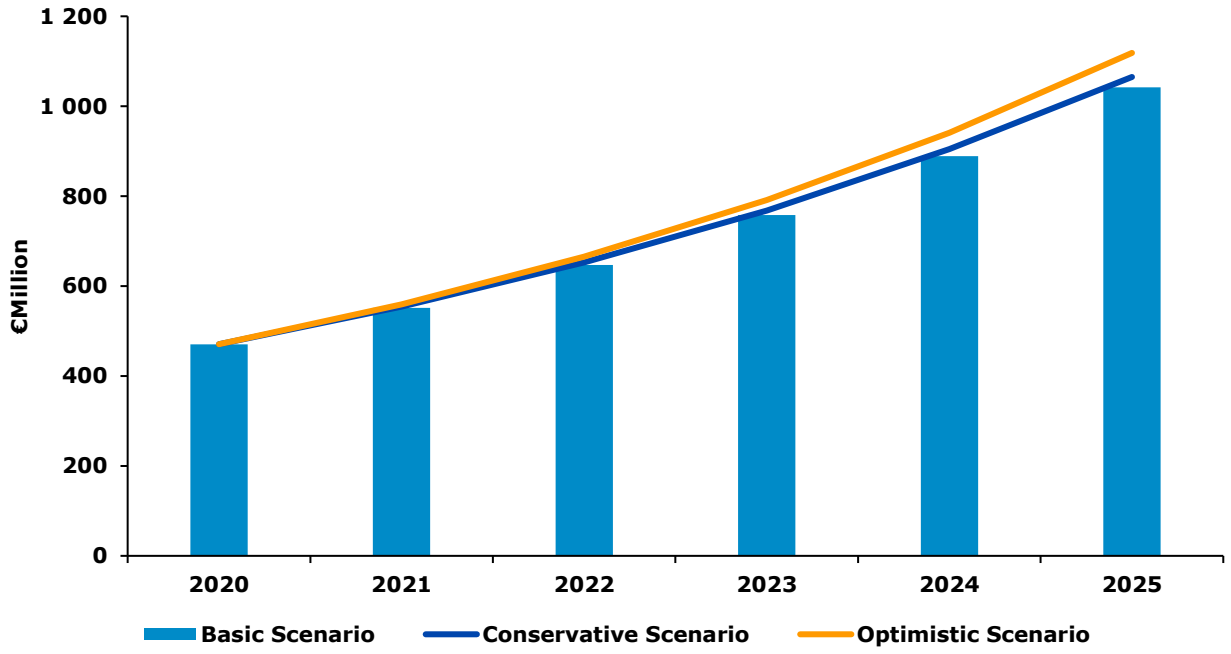

Figure 48. Prediction of the size of the EU fullerenes NMs per value for the period 2021 – 2025.

6.3.4.4 EU carbon-based NMs market 5-year projection overview

Based on the results above, the calculated CAGRs for the combined EU carbon-based NMs market are 26.1% and 25.3% per volume and value, respectively, for the basic scenario. For the conservative scenario the CAGRs are 22.4% and 20% per volume and value, respectively. For the optimistic scenario, the CAGRs are 163.8% and 99.7% per volume and value, respectively. The results are presented in Tables 13 and 14 and Figures 49 and 50.

TABLE 13: FIVE-YEAR EU CARBON-BASED NMS MARKET PREDICTIONS PER VOLUME.

Year	Conservative Scenario (20% CAGR)	Basic Scenario (26.1% CAGR)	Optimistic Scenario (163.8% CAGR)
2020	0.85	0.85	0.85
2021	0.98	1.02	1.83
2022	1.13	1.23	3.96
2023	1.31	1.48	8.61

2024	1.51	1.78	18.81
2025	1.76	2.15	41.19

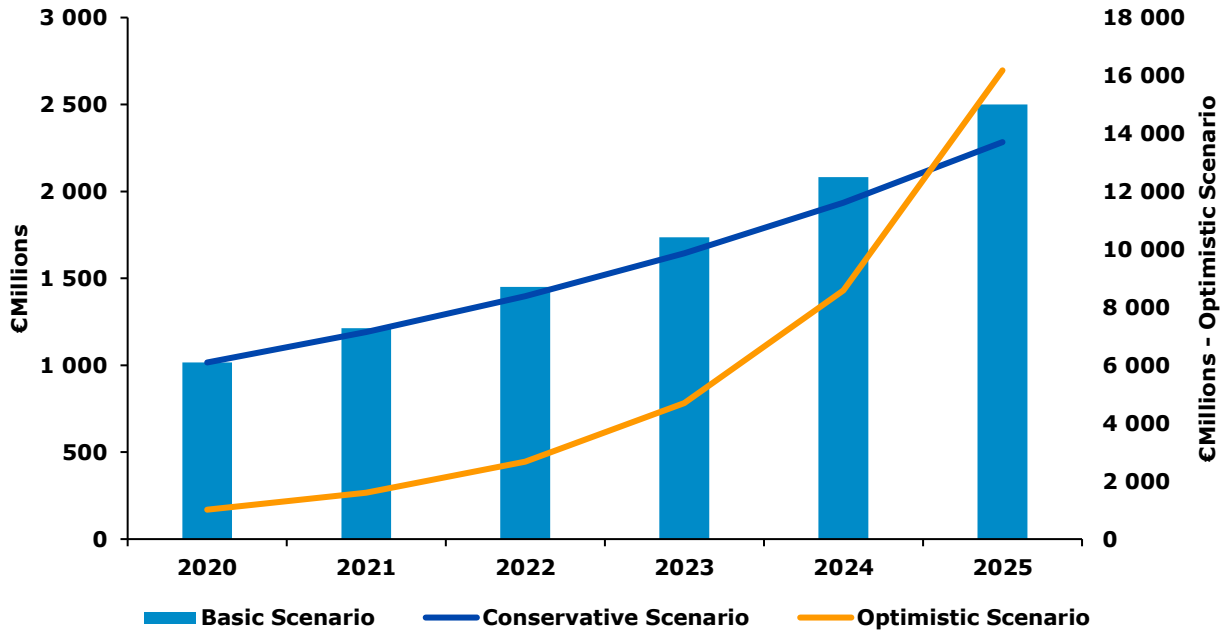

Figure 49. Prediction of the size of the EU carbon-based market per volume for the period 2021 – 2025.

TABLE 14: FIVE-YEAR EU CARBON-BASED NMS MARKET PREDICTIONS PER VALUE.

Year	Conservative Scenario (22.4% CAGR)	Basic Scenario (25.3% CAGR)	Optimistic Scenario (99.7% CAGR)
2020	1,015.97	1,015.97	1,015.97
2021	1,190.84	1,212.85	1,598.51
2022	1,397.86	1,449.87	2,668.55
2023	1,643.45	1,735.80	4,689.80
2024	1,935.45	2,081.51	8,582.62

2025	2,283.45	2,500.53	16,178.19

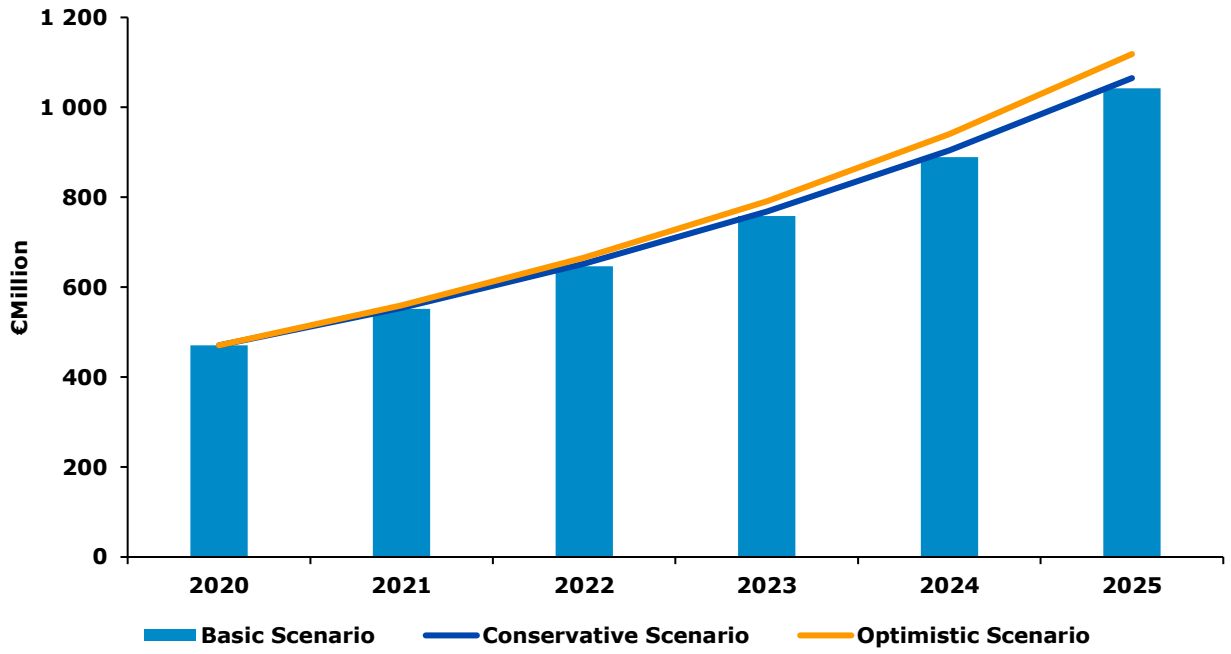

Figure 50. Prediction of the size of the EU carbon-based NMs per value for the period 2021 – 2025.

6.3.5 Dendrimers

According to Inkwood Research [4] the EU dendrimers market volume is in 2020 0.06 Kilotons and presented to grow with a CAGR of 15.7%. It is worth 1.04 € million in 2020 and is predicted to grow with an anticipated CAGR of 17.65%. Due to the lack of sufficient data, we assume that as the basic scenario. In this case, by 2025 the dendrimers market will have a volume of 0.12 Kilotons and worth 2.34 € million.

Dendrimers have characteristics that make them suitable for many uses, especially in the medicine and personal care fields. For this reason, the demand for dendrimers is expected to rise in the next 5 years, with inhibiting factors being potential changes to regulation and costs for scaling up production.

6.3.6 Nanoclays

The EU nanoclays market has a volume of 15 Kilotons and is worth 64.41 € million in 2020 [4]. In the basic scenario, it is projected to increase with an average CAGR of 10.8% per volume and 11.3% per value [4], [130]–[132] (Tables 15 and 16, Figures 51 and 52), demonstrating the power of suppliers and the market specialisation. In the conservative scenario the EU nanoclays market is projected to increase by an average CAGR of 6% per volume and 9% per value. In the optimistic scenario, the increase will be 16.04% per volume and 18.65% per value.

Nanoclays have huge demand and application in the coating and packaging sectors. Nanoclay reinforced products demonstrate improved thermal, mechanical and biodegradable properties, while inhibiting microbial and contaminating agents from entering the packages. Their advantages and relative low cost make them ideal and highly competitive boosting the sector

[132]. Other growth opportunities are within the automotive and aerospace industries, as these use nanoclays to produce lightweight components, improving performance and lower fuel consumption [132]. Nanoclays are also used in ink formulations, wastewater treatment, and as drug vehicles [4].

Inhibiting factor is the stricter regulatory EU environment compared to other markets, which may be further hardened with the regulation of polymers, as nanoclays are used as additives to produce stronger and more functional materials. Another factor, is the high production costs that may limit scaling up and introducing high entry barriers into the market, as also mirrored in the higher CAGR for the market value compared to its volume, which demonstrates the ability of suppliers to keep the costs high and the difficulty of customers to change suppliers easily.

TABLE 15: FIVE-YEAR EU NANOCLAYS NMS MARKET PREDICTIONS PER VOLUME.

Year	Conservative Scenario (6% CAGR)	Basic Scenario (10.8% CAGR)	Optimistic Scenario (16.04% CAGR)
2020	15.00	15.00	15.00
2021	15.90	16.62	17.41
2022	16.85	18.41	20.20
2023	17.87	20.40	23.44
2024	18.94	22.61	27.20
2025	20.07	25.05	31.56

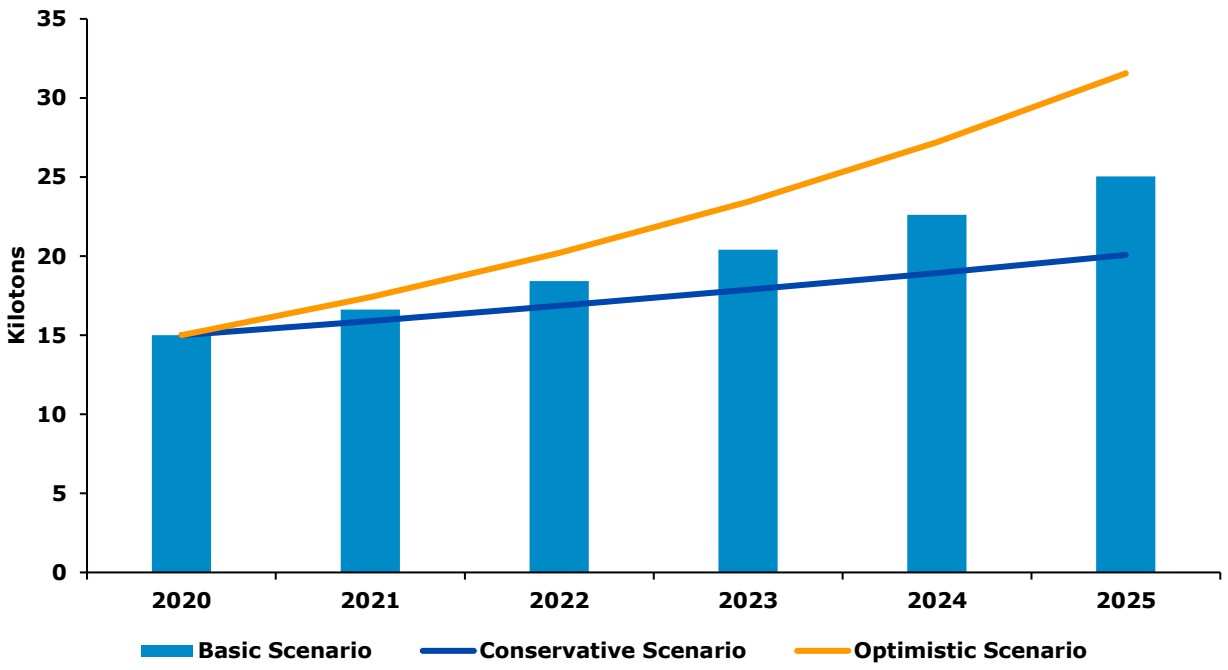

Figure 51. Prediction of the size of the EU nanoclays market per volume for the period 2021 – 2025.

TABLE 16: FIVE-YEAR EU NANOCLAYS NMS MARKET PREDICTIONS PER VALUE.

Year	Conservative Scenario (9% CAGR)	Basic Scenario (11.3% CAGR)	Optimistic Scenario (18.65% CAGR)
2020	64.41	64.41	64.41
2021	70.21	71.69	76.42
2022	76.53	79.79	90.68
2023	83.41	88.81	107.59
2024	90.92	98.84	127.65
2025	99.10	110.01	151.46

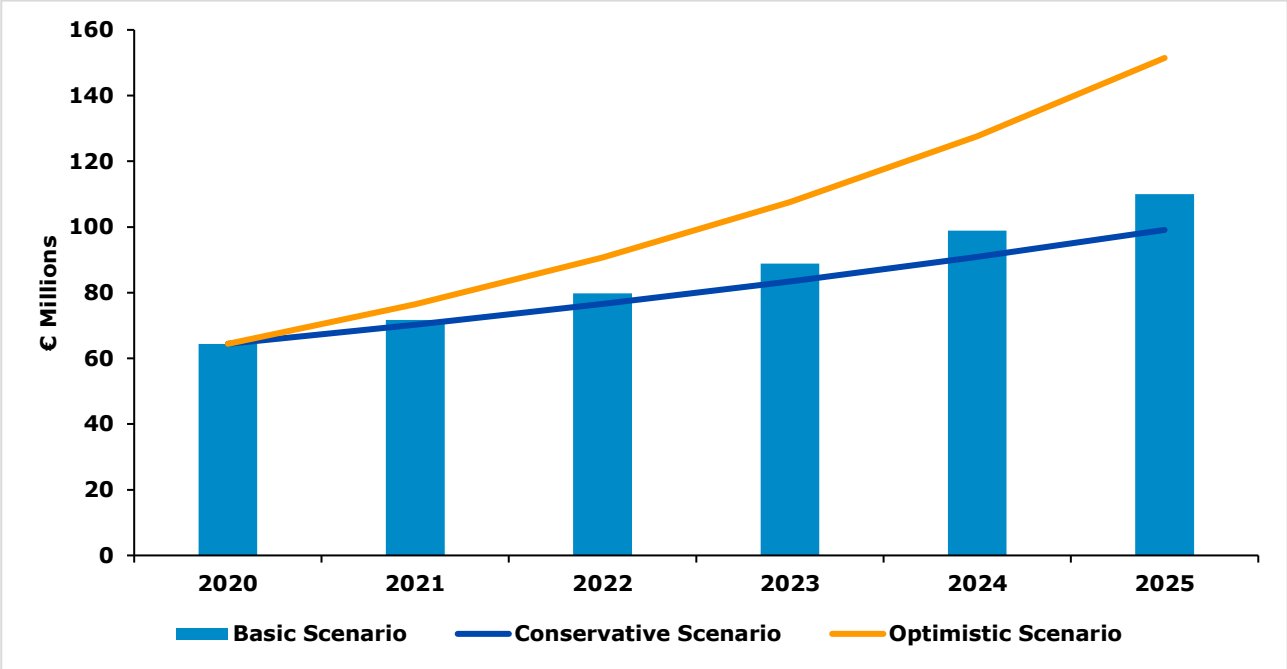

Figure 52. Prediction of the size of the EU nanoclays NMs per value for the period 2021 – 2025.

6.3.7 Nanocellulose

The EU nanocellulose market is, currently, considered to be the fastest growing in the world [133]. In 2020 it has a volume of 0.33 Kilotons and value of 27.58 € million [4]. As a fast-growing market, the project CAGR for the basic scenario is estimated to be 20.05% and 19.4% CAGR per volume and value, respectively [4], [9], [133], [134]. The conservative scenario is estimated as 18.05% and 14.24% CAGR per volume and value, respectively. The optimistic scenario is 24% and 22% per volume and value, respectively. The results are presented in Tables 17 and 18 and Figures 53 and 54.

Nanocellulose is a material that has several uses in various sectors, such as paper & paperboard, composite, food, absorbent & hygiene products, emulsion & dispersion, oil recovery, medical, pharmaceutical, cosmetics, and others [4]. The continuous increase in demand in the food, personal care, and medicine sectors drive growth. On the other hand, nanocellulose materials have been found to induce hazardous effects in humans, e.g., inflammatory effects, toxicity, inhibiting its growth opportunities [133].

TABLE 17: FIVE-YEAR EU NANOCELLULOSE NMS MARKET PREDICTIONS PER VOLUME.

Year	Conservative Scenario (18.05% CAGR)	Basic Scenario (20.05% CAGR)	Optimistic Scenario (24% CAGR)
2020	0.33	0.33	0.33
2021	0.39	0.40	0.41

2022	0.46	0.48	0.51
2023	0.54	0.57	0.63
2024	0.64	0.69	0.78
2025	0.76	0.82	0.97

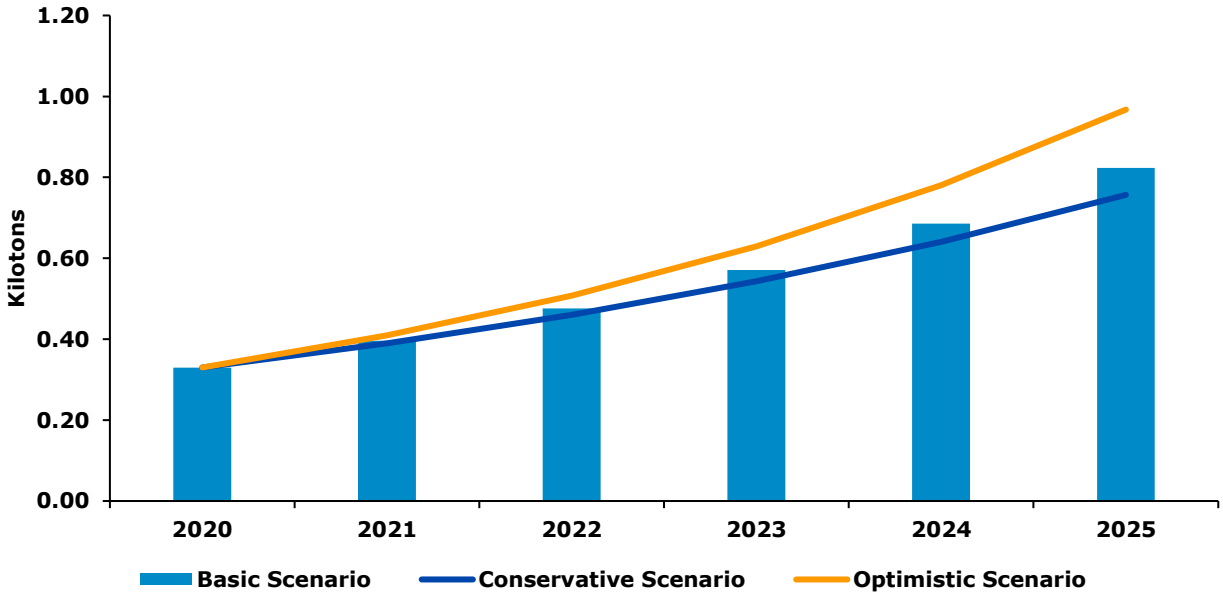

Figure 53. Prediction of the size of the EU nanocellulose market per volume for the period 2021 – 2025.

TABLE 18: FIVE-YEAR EU NANOCELLULOSE NMS MARKET PREDICTIONS PER VALUE.

Year	Conservative Scenario (14.24% CAGR)	Basic Scenario (19.4% CAGR)	Optimistic Scenario (22% CAGR)
2020	27.58	27.58	27.58
2021	31.51	32.93	33.65
2022	35.99	39.32	41.05
2023	41.12	46.95	50.08

2024	46.98	56.05	61.10
2025	53.66	66.93	74.54

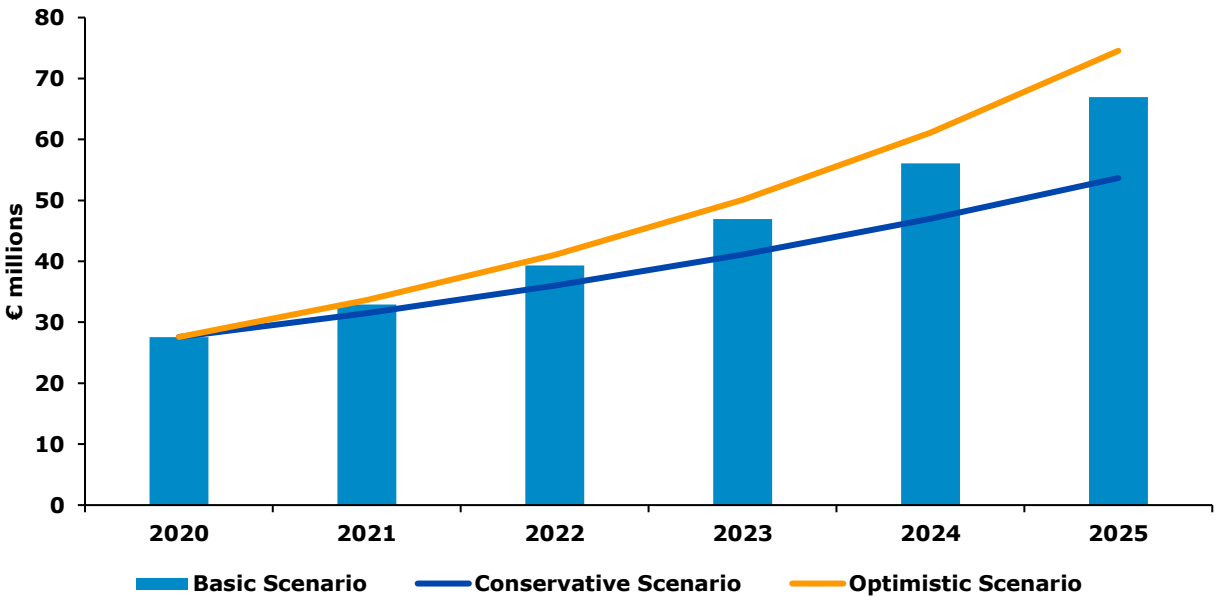

Figure 54. Prediction of the size of the EU nanocellulose NMs per value for the period 2021 – 2025.

6.3.8 EU NMs market overall projection

Based on the data presented above the EU NMs market is expected to grow, in the basic scenario, by 13.9% CAGR per volume and 18.4% CAGR per value, reaching 271.29 Kilotons and 12,631 € millions (Tables 19 and 20, Figures 55 and 56). In the conservative scenario, the growth will be 8.8% CAGR per volume and 14.1% CAGR per value. The optimistic scenario predicts CAGRs of 23.8% per volume and 48.8% per value.

TABLE 19: FIVE-YEAR EU NMS MARKET PREDICTIONS PER VOLUME.

Year	Conservative Scenario (8.8% CAGR)	Basic Scenario (13.9% CAGR)	Optimistic Scenario (23.8% CAGR)
2020	140.90	140.90	140.90
2021	153.30	160.63	174.43
2022	166.79	183.11	215.95
2023	181.47	208.75	267.35

2024	197.44	237.97	330.97
2025	214.81	271.29	409.75

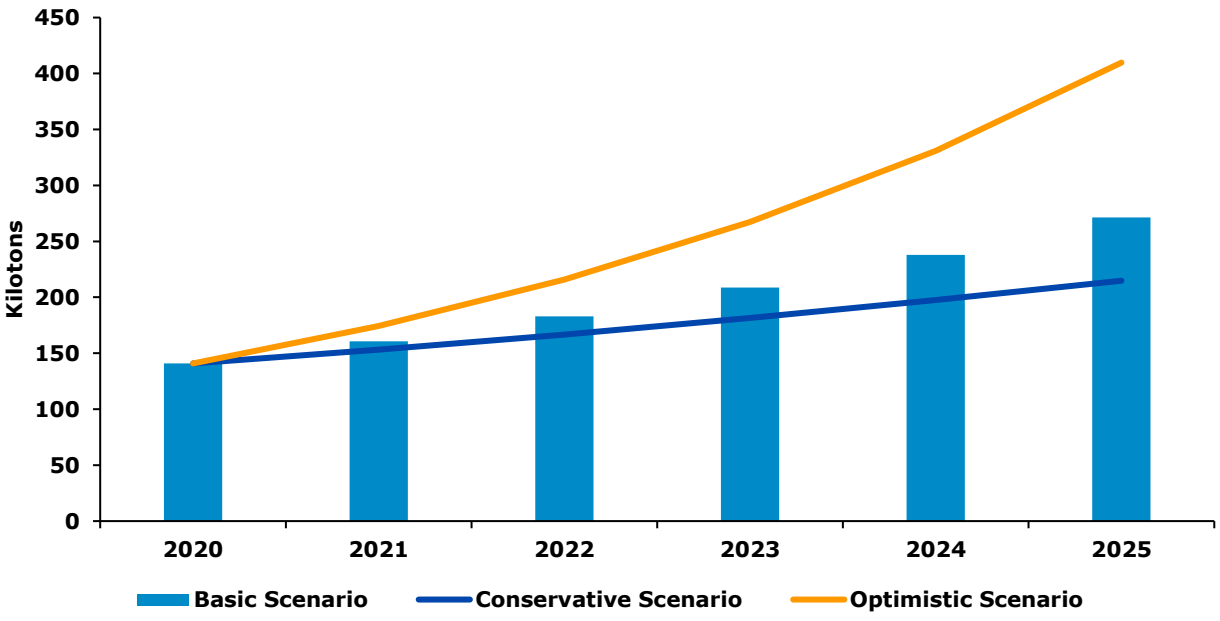

Figure 55. Prediction of the size of the EU NMs market per volume for the period 2021 – 2025.

TABLE 20: FIVE-YEAR EU NMS MARKET PREDICTIONS PER VALUE.

Year	Conservative Scenario (14.1% CAGR)	Basic Scenario (18.4% CAGR)	Optimistic Scenario (48.8% CAGR)
2020	5,205.00	5,205.00	5,205.00
2021	5,946.19	6,214.77	6,350.10
2022	6,792.93	7,420.44	7,747.12
2023	7,760.24	8,860.00	9,451.49
2024	8,865.30	10,578.84	11,530.82
2025	10,127.72	12,631.13	14,067.60

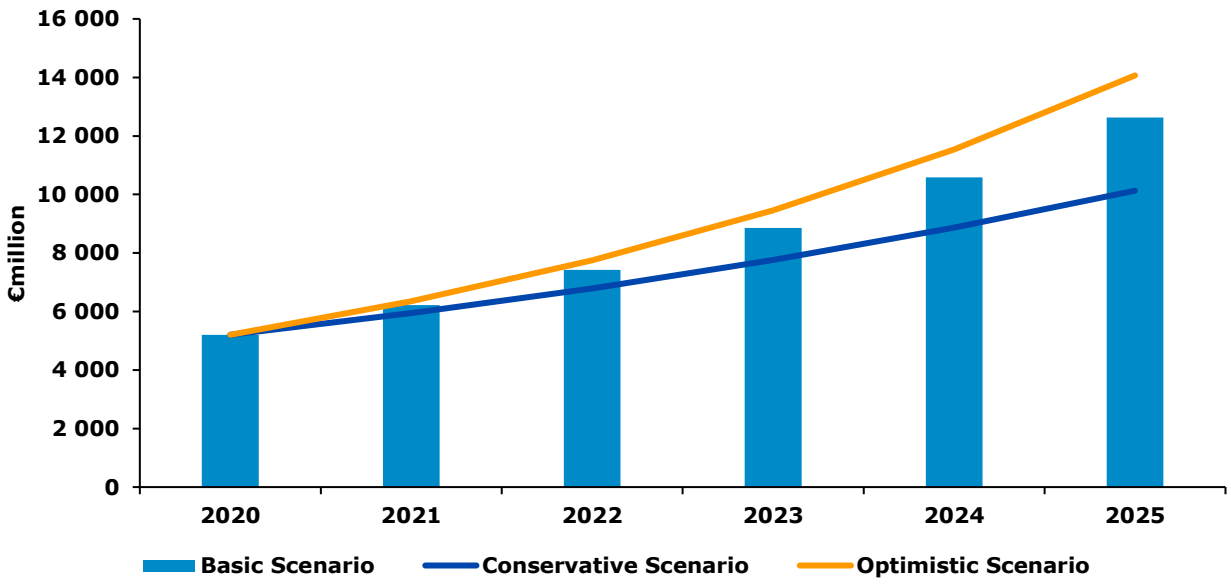

Figure 56. Prediction of the size of the EU NMs per value for the period 2021 – 2025.

The presented predictions are based on the assumptions presented in section 5.1 and it must be noted that future uncertainties (e.g., pandemics, regulatory landscape) may have a direct effect on these numbers.

Currently, the biggest NM segment is the metal oxides one, although the fastest growing segment is nanocellulose, with carbon-based NMs, and especially graphene, coming rapidly into the picture.

The key drivers for the NMs market are the rapid technological advancement, leading to increased demand for compact, high-speed electronics, which requires novel lightweight and highly functional materials. Similarly, the aerospace, automotive, energy, food packaging, construction and other industries require lightweight, functional, and robust materials, something that NMs can offer. Furthermore, the medicine and personal care sectors begin to rely heavily on NMs, due to their antimicrobial and imaging potential, their ability to pass tissues, be functionalised with other active substances and more.

To this end, public (EU and national) funding has significantly boosted the progress of the NMs market, which is expected to continue, considering the needs of the market and investment in the development of novel and advances materials, with a specific shift expected to 2D-materials. This boost, which started before 2010, has led over time in the development of more advanced and robust manufacturing lines and standardised manufacturing processes, which have substantially reduced the cost of NMs, making such products a lot more affordable to the EU market.

Market barriers include the regulatory landscape, which is stricter than in other regions and inhibits the introduction to the market of more novel NMs and respective products. On the other hand, the potential adverse effects on organisms and the environment may mean that a stricter regulatory regime can help increase public trust to NM-containing products, for which concerns currently exist [135], which was also expressed during the survey and interviews. Potential changes to the regulatory market, e.g., introduction of regulatory requirements for polymers, can further restrict the market. This will also influence the production costs, as companies will be reluctant to invest in scaling up production lines keeping the cost higher. This also affects the

competitive landscape, as it makes it harder for start-ups and SMEs to compete with established players. As a result, it is expected that other markets, mainly the Asia-Pacific region, will surpass the EU in NMs production, which may affect the EU NM producers in the mid- to long-term.

7. Conclusions

In this report we presented the EU NMs market, which were divided in 6 segments:

- Metal oxides
- Metals
- Carbon-based NMs (CNTs, graphene, fullerenes)
- Dendrimers
- Nanoclays
- Nanocellulose

The EU NMs market size is estimated, for 2020, to be 140.9 Kilotons per volume and 5,205 € millions per value. In the next 5 years the market is expected to grow with a CAGR of 13.9% per volume and 18.4% per value creating a strong positive socioeconomic impact for the EU, EEA, and Switzerland. While currently the largest segment is the metal oxides market, growth is forcast to mainly be driven by the nanoclay, nanocellulose and carbon-based NMs. For the latter, the interviewed experts expect a strong growth with estimates for all types (graphene, CNTs, fullerenes) reaching, and sometimes exceeding, the 100% annual growth mark.

Surprisingly, our interviews demonstrated that the ongoing SARS-COV-2 pandemic, did not lead to a market slow-down, with most interviewees expressing the opinion that the market grew, and the rest that it remained stable. On the other hand, Brexit influenced the market, as the UK had, up to 2020, a market share of around 10.5% per year. This loss, though, can be at least partly offset by a boost in the internal market and shift towards local suppliers. This is supported by the fact that while the UK has not yet implemented border controls for trade with the EU (border control is expected to be phased in by the UK during 2022), the EU has fully implemented these leading to higher import costs and red-tape for UK NM producers and NM-containing products manufacturers. This effect is expected to be boosted further, in the mid- to long-term, if the UK decides to move to a more lenient regulatory regime for NMs.

The key drivers for growth, in the EU NMs market, will be technological advancements, and the public demand for functional, lightweight, and affordable state-of-the art products. The aerospace, automotive, energy, food packaging, construction, and other industries will also drive growth, as NMs provide huge opportunities to increase performance and reduce costs. Similarly, the use of NMs in medicine and personal care, which is already happening, will boost the market especially in the case that novel NMs, e.g., carbon-based, can get regulatory approval for usage. This is expected to happen in the mid-term, considering the EU's interest in the topic, expressed via the 1 billion Euro investment in the Graphene Flagship to assist with the material's commercialisation. This is further boosting the already significant public funding of NMs, which has helped in the development of more advanced and robust manufacturing lines and standardised manufacturing processes, which have substantially reduced the cost of NMs, making them much more affordable to the EU market.

The main barriers for growth, as expressed during our surveys and interviews, are perceived to be the current regulatory landscape, which does not allow an easy commercialisation of NM-

containing products, the negative public opinion, and the lack of investment for scaling up production, reducing manufacturing and subsequently the NM containing products costs. While the strict regulatory landscape may initially hinder stronger growth, it can eventually increase public trust in NM-containing products boosting the market. In the meantime, increasing the strictness of legislation, e.g., by introducing regulatory requirements for polymers, which for example are used in conjunction with nanoclays, may further hinder the market and affect the calculated projections.

The EU NMs market is dominated by Germany, which has most producers and downstream users. In total, 1,168 NM organisations were identified on the EU, EEA, and Swiss market. Eighty-eight of those are NMs producers, with 27.2% being based in Germany, followed by Spain (11%) and France (9.1%). Out of the 1,054 downstream users, Germany leads the market with 34.6%, followed by France (11.9%) and Sweden (7%). Further research allowed us to provide, as a first estimate of the number of products, that 2,800 existing NM-containing products (excluding NMs production) are on the market, with Germany again leading the market with 35.4%, followed by Switzerland with 20.4% and Sweden with 5.7%.

Most of organisations were identified as belonging to the fields of manufacturing, medicine and life sciences, personal care, and instrumentation and electronics. Further segmentation identified the two most dominant segments and their market shares: coatings, paints and sealants (18.8%), and instrumentation and electronics (17.8%), noting as well that the combination of the medicine and personal care segments would lead to a dominant segment of 20.3%.

Finally, we have identified 92 NM substances available on the EU, EEA, and Swiss market, which are not listed in any of the inventories reported by EUON, although it is not clear how many of these substances are above the 1 tonne/year of combined bulk and nano production threshold for which registration obligations under REACH may apply. We need to note here that specific uncertainties exist regarding the identified substances. These include how NMs-doped NMs and alloys should be dealt with. In all cases, the potential of substantial changes in the NMs properties exists through interaction with the surrounding environment or structural disruptions at doping levels a lot higher than those of the impurities.

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Annex

Table A1: Identified NM producers based in the EU and EEA countries & Switzerland, and the UK.

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Austria	PHORNANO	Producer	Metal NMs	Quantum dots	Substrates	Fluorescent nanoprobes	
Belgium	Nanocyl SA	Producer	Carbon nanotubes				
Belgium	Tokyo (TCI) Chemical Industry	Producer	Carbon NMs	Fullerenes			
Belgium	Emexon International	Producer	Ag NMs				
Belgium	Ardena	Producer	Nanomaterials	Polymers	Liposomes	Silica	Metals
Belgium	Solvay	Producer	Various				
Czech Republic	Pardam Nano4Fibers	Producer	Nanofibres	Inorganic	Polymeric	Membranes	

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Czech Republic	Advanced Materials-JTJ	Producer	Nanoparticles	Ceramic oxides			
Czech Republic	NanoIron	Producer	Nanoparticles	Iron-based			
Estonia	Nanoarc	Producer	Various				
Estonia	UP Catalysts	Producer	Carbon NMs	Graphene	CNTs	Graphite	Nanofibres
Estonia	PRO-1 NANOSolutions	Producer	Nanoparticles	Metals	Nanocomposites		
Finland	Canatu	Producer	Carbon NMs	Films	Sensors	Automotive	Semiconductors
Finland	Carbodeon	Producer	Carbon NMs	Nanodiamonds			
Finland	PuraliQ	Producer	Metal NMs				
France	Marion Technologies	Producer	Nanomaterials	Metals	Metal oxides	Carbides	
France	Carbon Waters	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
France	Attonuclei	Producer	QDs				
France	Baikowski	Producer	Nanomaterials	Ceramics	Lighting	Bioceramics	Polishing
France	Mathym	Producer	Nanomaterials	Metals			
France	Nanoe	Producer	Nanomaterials	Metals	Composites		
France	Nanomakers	Producer	Nanomaterials	Silicon-based			
France	SON	Producer	Nanomaterials	Metals	Functionalised	Catalysts	
Germany	FutureCarbon GmbH	Producer	Carbon-based	CNTs	Electrics	Composites	
Germany	Plasmachem GmbH	Producer	Nanomaterials	Metals	Fullerenes	Graphite	Graphene
Germany	IoLiTec Ionic Liquids Technologies	Producer	Nanomaterials	Metals	Metal oxides	Fullerenes	Graphene
Germany	Sixonia Tech	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Germany	ABCR	Producer	Nanomaterials	CNTs	Metals		
Germany	Bio-Gate	Producer	Nanomaterials	Metals	Coatings	Medical technology	Cosmetics
Germany	Buehler PARTEC GmbH	Producer	Nanomaterials	Manufacturing			
Germany	Evonik	Producer	Nanomaterials	Silica	Adhesives	Sealants	
Germany	IBU-tec advanced materials	Producer	Nanomaterials	Metals	Ceramics		
Germany	micromod Partikeltechnologie	Producer	Nanomaterials	Inorganic	Organic		
Germany	Microparticles GmbH	Producer	Nanomaterials	Metals	Polymeric	Composites	
Germany	Nandatec	Producer	Nanomaterials	Biocompatible			
Germany	Particular	Producer	Nanomaterials	Metals	Catalysts		
Germany	Pinfire	Producer	Nanoparticles	Silica			

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Germany	Wacker	Producer	Nanomaterials	Polymers	Organics	Coatings	Inks
Germany	Merck (Sigma Aldrich)	Producer	Nanomaterials	Various			
Germany	Fisher Scientific	Producer	Nanomaterials	Various			
Germany	BASF	Producer	Nanomaterials				
Germany	BYK-Chemie	Producer	Nanomaterials				
Germany	Lanxess	Producer	Nanomaterials				
Germany	Magnetec	Producer	Nanomaterials				
Germany	MyBiotech	Producer	Nanomaterials				
Germany	PolyAn	Producer	Nanomaterials				
Germany	VAC Vacuumschmelze	Producer	Nanomaterials				
Greece	Glonatech	Producer	Nanomaterials	CNTs			

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Greece	Nanothinx S.A.	Producer	Nanomaterials	CNTs			
Greece	PLIN Nanotechnology	Producer	Nanomaterials	Metals	Metal oxides		
Ireland	NanoDiamond Products	Producer	Nanomaterials	Nanodiamonds			
Italy	BeDimensional	Producer	Nanomaterials	Graphene	Nitrides	Metals	
Italy	Directa Plus	Producer	Graphene				
Italy	Nanesa	Producer	Graphene				
Italy	HiQ-Nano	Producer	Nanomaterials	Silica	Metals	Polymeric	
Italy	MBN Nanomaterialia S.p.A.	Producer	Nanomaterials	Metals	Composites	Alloys	
Latvia	Modern Synthesis Technology	Producer	Nanomaterials	Graphene	Fullerenes	CNTs	Polymers
Luxemburg	OCSiAl	Producer	CNT				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Netherlands	HQ Graphene	Producer	Graphene				
Netherlands	SACHEM	Producer	Nanomaterials	Ceramics			
Norway	Abalonyx	Producer	Graphene				
Norway	Cealtech	Producer	Graphene				
Norway	Norwegian Graphite	Producer	Graphite				
Norway	TioTech	Producer	Titania				
Poland	Amepox	Producer	Metal NMs				
Poland	NanoSeen	Producer	Various				
Poland	Advanced Graphene Products	Producer	Graphene				
Poland	Nano Carbon Graphene Technologies	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Poland	nanoEMI	Producer	Nanomaterials	Metals	Graphene	Electronics	Aerospace
Poland	SilverCon	Producer	Nanomaterials	Metals			
Portugal	Graphenest	Producer	Graphene				
Portugal	Fluidinova	Producer	Nanomaterials	Phosphates	Medicine	Food	
Spain	Grupo Antolin	Producer	Nanofibres	Carbon	Graphene		
Spain	Nanogap	Producer	Nanomaterials	Catalytic	Conductive	Antimicrobial	Luminescent
Spain	Tecnan	Producer	Nanomaterials	Oxides			
Spain	Avanzare	Producer	Graphene				
Spain	Gnanomat	Producer	Graphene	Composites			
Spain	Graphenano	Producer	Graphene				
Spain	Graphenea Nanomaterials	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
Spain	Nanoinnova Technologies	Producer	Nanomaterials	Graphite	Graphene		
Spain	AD-Particles	Producer	Various				
Spain	Nanotex Nanotechnological Solutions	Producer	Various				
Sweden	2D fab	Producer	Graphene				
Sweden	Graphensic	Producer	Graphene				
Sweden	Graphmatech	Producer	Graphene				
Sweden	Talga	Producer	Graphene	Metals			
Sweden	Cline Scientific	Producer	Nanosurfaces	Nanomedicine			
Sweden	Genovis	Producer	Nanomaterials	Nanomedicine			
Switzerland	Avantama	Producer	Nanomaterials	Oxides	QDs	Electronics	

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
UK	2-Dtech	Producer	Graphene	Polymers			
UK	Applied Graphene Materials	Producer	Graphene				
UK	BBI Solutions	Producer	Nanomaterials	Gold			
UK	BGT Materials	Producer	Graphene				
UK	Cambridge Nanosystems	Producer	Graphene				
UK	Ceimig	Producer	NMs Producer				
UK	First Graphene	Producer	Graphene				
UK	GOgraphene	Producer	Graphene				
UK	Goodfellow	Producer	Nanomaterials	Carbon			
UK	Graphene Composites	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
UK	Graphene Industries	Producer	Graphene				
UK	GrapheneLab	Producer	Graphene				
UK	Graphitene	Producer	Graphene	CNTs			
UK	Haydale	Producer	Nanomaterials	Resins			
UK	Hubron	Producer	Carbon	Conductive			
UK	Keeling & Walker	Producer	Nanomaterials	Tin			
UK	Liquids Research	Producer	Nanomaterials	Magnetic			
UK	Nanoco Technologies Limited	Producer	Nanomaterials	QDs			
UK	Nanoforce Technology	Producer	NMs Producer				
UK	Ossila	Producer	Nanomaterials	QDs			

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
UK	Paragraph	Producer	Graphene	Sensors			
UK	Particle Works	Producer	NMs Producer	https://www.particle-works.com/			
UK	Perpetuus Advanced Materials	Producer	Graphene	CNTs			
UK	Promethean Particles	Producer	Nanomaterials	Metals			
UK	Q-FLO	Producer	NMs Producer	https://q-flo.com/			
UK	QinetiQ Nanomaterials Ltd.	Producer	Nanomaterials	Nanopowders			
UK	RD Graphene	Producer	Graphene	Electronics			
UK	ShimyaTech	Producer	Nanomaterials	Metals			
UK	Strem Chemicals UK	Producer	Nanomaterials	Graphene			
UK	Thomas Swan	Producer	Graphene				

Country	Organisation	Category	Subcategory	Subcategory	Subcategory	Subcategory	Subcategory
UK	Versarien	Producer	Graphene				
UK	William Blythe	Producer	Graphene				

Table A2: Identified NM downstream users in the EU, EEA & Switzerland, and the UK markets.

Country	Organisation	Category	Sector
Austria	Anton Paar	Analysis	Instrumentation
Austria	PLANSEE	Energy	Coatings & Paints
Austria	EV Group	Instrumentation	Lithography & Printing
Austria	Hairdreams Haarhandels GmbH	Personal Care	Cosmetics & Personal Care
Austria	IMS Nanofabrication	Manufacturing	Lithography & Printing
Austria	Life Light Handels GmbH	Food & Feed	Food & Feed
Austria	MERX PRODUCTS	Medicine	Medicine

Country	Organisation	Category	Sector
Austria	Neosino	Personal Care	Cosmetics & Personal Care
Austria	NNT BORPOWER GMBH	Petroleum	Aerospace & Automotive
Austria	Northland	Clothing	Textiles
Austria	Pfanner Schutzbekleidung GmbH	Clothing	Textiles
Austria	PPC Insulators Austria GmbH	Manufacturing	Energy
Austria	Profactor	Manufacturing	Instrumentation
Austria	Pro's Pro Versand GmbH	Sport & Fitness	Sport and Fitness
Austria	Simplon	Sport & Fitness	Sport and Fitness
Austria	Thiomatrix	Medicine	Medicine
Austria	Vadlau Gmbh	Manufacturing	Coatings & Paints
Belgium	3B-the fibreglass company	Manufacturing	Aerospace & Automotive

Country	Organisation	Category	Sector
Belgium	Ablynx	Medicine	Medicine
Belgium	Agfa-Gevaert Group	Manufacturing	Lithography & Printing
Belgium	Bergasol	Personal Care	Cosmetics & Personal Care
Belgium	Bufalo	Clothing	Clothing & Personal Equipment
Belgium	Clean-X	Home Care	Home, Garden, Environment
Belgium	Convergent Group S.A.	Construction	Constructions
Belgium	Establishment Labs S.A.	Medicine	Medicine
Belgium	Eval	Food packaging	Coatings & Paints
Belgium	it4ip	Manufacturing	Instrumentation
Belgium	Janssen Pharmaceuticals, Inc	Medicine	Medicine

Country	Organisation	Category	Sector
Belgium	LifeFilta	Home Care	Home, Garden, Environment
Belgium	MARLY S.A.	Petroleum	Aerospace & Automotive
Belgium	NanoMEGAS	Analysis	Instrumentation
Belgium	Ocean Nutrition Europe	Food & Feed	Food & Feed
Belgium	Olivia Garden	Personal Care	Cosmetics & Personal Care
Belgium	Umicore automobile catalyst	Manufacturing	Aerospace & Automotive
Belgium	Velleman N.V.	Manufacturing	Lithography & Printing
Bulgaria	Budget Sensors	Analysis	Instrumentation
Cyprus	Bosti Trading LTD.	Medicine	Medicine
Cyprus	Baby Pink or Blue	Personal Care	Cosmetics & Personal Care
Cyprus	Nanoliz	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Czech Republic	Advamat s.r.o.	Construction	Constructions
Czech Republic	Altermed a.s.	Medicine	Medicine
Czech Republic	ASIO, spol. s r.o.	Home Care	Home, Garden, Environment
Czech Republic	Azacycles	Medicine	Medicine
Czech Republic	BOCHEMIE a.s.	Construction	Constructions
Czech Republic	Contipro Group	Medicine	Medicine
Czech Republic	Crytur	Analysis	Instrumentation
Czech Republic	ERC-TECH a. s.	Construction	Constructions

Country	Organisation	Category	Sector
Czech Republic	FILTREX s.r.o.	Food & Feed	Food & Feed
Czech Republic	FN - NANO sro	Home Care	Home, Garden, Environment
Czech Republic	HE3DA Ltd.	Manufacturing	Energy
Czech Republic	ING Medical	Medicine	Medicine
Czech Republic	InoCure	Manufacturing	Instrumentation
Czech Republic	IQS GROUP	Manufacturing	Energy
Czech Republic	Iuven.io S.r.o.	Personal Care	Cosmetics & Personal Care
Czech Republic	JIMIPLET sro	Manufacturing	Textiles

Country	Organisation	Category	Sector
Czech Republic	KAMA spol s. r.o	Clothing	Textiles
Czech Republic	Kilpi	Clothing	Textiles
Czech Republic	Lada Vyvialova Creative Platform s.r.o.	Clothing	Textiles
Czech Republic	MemBrain	Manufacturing	Coatings & Paints
Czech Republic	NAFIGATE Corporation a. s.	Agriculture	Home, Garden, Environment
Czech Republic	NANO CHEMI GROUP s.r.o.	Construction	Coatings & Paints
Czech Republic	Nano Medical s.r.o.	Medicine	Medicine
Czech Republic	Nanobala sro	Construction	Home, Garden, Environment

Country	Organisation	Category	Sector
Czech Republic	Nanologix Corporation, S.r.o.	Medicine	Medicine
Czech Republic	Nanopharma a.s.	Personal Care	Cosmetics & Personal Care
Czech Republic	NanoShop	Manufacturing	Textiles
Czech Republic	Nanosilver	Clothing	Textiles
Czech Republic	NanoSPACE s.r.o.	Home Care	Textiles
Czech Republic	Nanotex Group	Fabrication	Textiles
Czech Republic	NanoTrade Ltd.	Manufacturing	Textiles
Czech Republic	Nanovia Ltd	Manufacturing	Textiles

Country	Organisation	Category	Sector
Czech Republic	NenoVision	Analysis	Instrumentation
Czech Republic	PARDAM NANO4FIBERS sro	Medicine	Medicine
Czech Republic	PIKATEC CZ Ltd.	Automotive	Coating, Paints, Sealants
Czech Republic	RESPILON Group s. r. o.	Medicine	Medicine
Czech Republic	Retap spol. s ro	Home Care	Home, Garden, Environment
Czech Republic	SAFETY NANO PROTECT s.r.o.	Medicine	Medicine
Czech Republic	SCIMED Biotechnologies s.r.o.	Medicine	Medicine
Czech Republic	SEN WORLD, sro	Medicine	Medicine

Country	Organisation	Category	Sector
Czech Republic	Smart Coatings sro	Manufacturing	Coatings & Paints
Czech Republic	SpofaDental a.s.	Medicine	Medicine
Czech Republic	SPUR a.s.	Medicine	Medicine
Czech Republic	Tendon	Clothing	Clothing & Personal Equipment
Czech Republic	Tescan	Analysis	Instrumentation
Czech Republic	TTS Thin Film Technological Service	Manufacturing	Coatings & Paints
Czech Republic	XERO ULTIMATE window film	Automotive	Coatings & Paints
Czech Republic	Zena-membranes	Manufacturing	Coatings & Paints

Country	Organisation	Category	Sector
Denmark	AQUAporin	Manufacturing	Home, Garden, Environment
Denmark	Asics	Clothing	Clothing & Personal Equipment
Denmark	Asivik	Clothing	Clothing & Personal Equipment
Denmark	ATLANT 3D Nanosystems	Manufacturing	Constructions
Denmark	Basta	Automotive	Coatings & Paints
Denmark	Beauté Pacifique	Personal Care	Cosmetics & Personal Care
Denmark	Billigbilpleje	Manufacturing	Aerospace & Automotive
Denmark	CARPES (KLA Group)	Analysis	Instrumentation
Denmark	Cphnano - Copenhagen Nanosystems	Manufacturing	Instrumentation
Denmark	Dansani A/S	Home Care	Home, Garden, Environment

Country	Organisation	Category	Sector
Denmark	Dyrup Professionel	Construction	Coatings & Paints
Denmark	FOM Technologies	Instrumentation	Energy
Denmark	FZ FORZA	Clothing	Clothing & Personal Equipment
Denmark	Gastrolux Cookware	Home Care	Home, Garden, Environment
Denmark	Green People	Personal Care	Cosmetics & Personal Care
Denmark	Gul	Clothing	Clothing & Personal Equipment
Denmark	Gun-Britt	Personal Care	Cosmetics & Personal Care
Denmark	Gundsø Markiser A/S	Construction	Constructions
Denmark	Haldor Topsoe	Manufacturing	Constructions
Denmark	Hempel	Manufacturing	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Denmark	Idento Group A/S	Personal Care	Cosmetics & Personal Care
Denmark	InMold Biosystems	Manufacturing	Constructions
Denmark	ISO PAINT NORDIC A/S	Home Care	Coatings & Paints
Denmark	LiPlasome Pharma	Medicine	Medicine
Denmark	NANO NORDISK	Home Care	Aerospace & Automotive
Denmark	NanoCover	Home Care	Home, Garden, Environment
Denmark	Nano-Lotus	Home Care	Aerospace & Automotive
Denmark	NIL Technologies	Manufacturing	Lithography & Printing
Denmark	Nilfisk	Home Care	Home, Garden, Environment
Denmark	Nordic Air Filtration	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Denmark	Nowocoat A/S	Manufacturing	Coatings & Paints
Denmark	NU SKIN	Personal Care	Cosmetics & Personal Care
Denmark	OBH Nordica	Personal Care	Cosmetics & Personal Care
Denmark	RAW	Home Care	Coatings & Paints
Denmark	RD Support	Medicine	Instrumentation
Denmark	Sadolin	Home Care	Coatings & Paints
Denmark	SILHORKO-EUROWATER	Manufacturing	Home, Garden, Environment
Denmark	Skin Vital Concept	Medicine	Medicine
Denmark	SONNX	Manufacturing	Aerospace & Automotive
Denmark	Stensborg	Manufacturing	Lithography & Printing
Denmark	StoneColor	Home Care	Coatings & Paints

Country	Organisation	Category	Sector
Denmark	Stonetreatment A / S	Home Care	Home, Garden, Environment
Denmark	TCnano	Manufacturing	Coatings & Paints
Denmark	Tender	Home Care	Textiles
Denmark	Xtreme	Clothing	Clothing & Personal Equipment
Estonia	GoGoNano	Manufacturing	Coatings & Paints
Estonia	IKO Science	Analysis	Instrumentation
Estonia	nanoFormula factory	Manufacturing	Coatings & Paints
Estonia	Skeleton Technologies	Manufacturing	Energy
Finland	AAVI Technologies Co.	Manufacturing	Home, Garden, Environment
Finland	Alpine Electronics, Inc	Manufacturing	Energy

Country	Organisation	Category	Sector
Finland	Atomic Snow	Clothing	Clothing & Personal Equipment
Finland	Beneq	Manufacturing	Coatings & Paints
Finland	Carbodeon Ltd	Manufacturing	Energy
Finland	Claeris Oy Ltd.	Construction	Constructions
Finland	Comptek Solutions	Manufacturing	Lithography & Printing
Finland	DCA Instruments	Manufacturing	Coatings & Paints
Finland	EXEL Sports	Personal Equipment	Clothing & Personal Equipment
Finland	Genano	Manufacturing	Home, Garden, Environment
Finland	Inkron	Manufacturing	Instrumentation
Finland	Liekki	Manufacturing	Energy

Country	Organisation	Category	Sector
Finland	milliDyne	Manufacturing	Coatings & Paints
Finland	Montreal Hockey	Personal Equipment	Clothing & Personal Equipment
Finland	Nanocomp	Manufacturing	Energy
Finland	NanoForm	Medicine	Medicine
Finland	Nanoksi Finland Oy	Home Care	Coatings & Paints
Finland	Optitune	Construction	Constructions
Finland	Picosun	Manufacturing	Coatings & Paints
Finland	STORA ENSO	Manufacturing	Home, Garden, Environment
Finland	Vision Fly Fishing	Personal Equipment	Clothing & Personal Equipment
France	Aenova France SAS	Medicine	Medicine

Country	Organisation	Category	Sector
France	Ademtech	Medicine	Instrumentation
France	Altuglas	Construction	Coatings, Paints, sealants
France	Aqua Health Products Inc	Manufacturing	Home, Garden, Environment
France	Aselta Nanographics	Manufacturing	Instrumentation
France	Aurea Technology	Analysis	Instrumentation
France	Avene	Personal Care	Cosmetics & Personal Care
France	Babolat	Sport & Fitness	Clothing & Personal Equipment
France	BaByliss PRO	Personal Care	Cosmetics & Personal Care
France	Balenciaga	Clothing	Textiles
France	Balmain	Clothing	Textiles

Country	Organisation	Category	Sector
France	Big Shave Club	Home Care	Clothing & Personal Equipment
France	Bioderma	Personal Care	Cosmetics & Personal Care
France	bioMérieux	Medicine	Medicine
France	Cameca Science & Metrology Solutions	Analysis	Instrumentation
France	Celine	Clothing	Textiles
France	Chanel	Personal Care	Cosmetics & Personal Care
France	Chantecaille	Personal Care	Cosmetics & Personal Care
France	CHIMILAB ESSOR	Manufacturing	Polymers
France	Chloé	Clothing	Textiles
France	Cilas	Manufacturing	Instrumentation
France	CMD diffusion	Medicine	Medicine

Country	Organisation	Category	Sector
France	Cordouan Technologies	Analysis	Instrumentation
France	Corial	Manufacturing	Lithography & Printing
France	CSInstruments	Analysis	Instrumentation
France	CYTOO	Medicine	Instrumentation
France	Degrémont Technologies Ltd.	Manufacturing	Home, Garden, Environment
France	Dickson-Constant®	Construction	Textiles
France	Dior	Personal Care	Cosmetics & Personal Care
France	Eider	Clothing	Textiles
France	Elvesys	Manufacturing	Instrumentation
France	Euris	Manufacturing	Energy
France	EviDenS	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
France	Fluigent	Analysis	Instrumentation
France	FOGALE nanotech	Analysis	Instrumentation
France	Fred Perrin	Home Care	Home, Garden, Environment
France	G.M. Collin	Personal Care	Cosmetics & Personal Care
France	Garnier	Personal Care	Cosmetics & Personal Care
France	Givenchy	Clothing	Textiles
France	Isabelle Lancray	Personal Care	Cosmetics & Personal Care
France	Isis Pharma	Medicine	Medicine
France	ITENA	Medicine	Medicine
France	Jean Louis David	Personal Care	Cosmetics & Personal Care
France	Jilbère	Personal Care	Clothing & Personal Equipment

Country	Organisation	Category	Sector
France	KÉRASTASE	Personal Care	Cosmetics & Personal Care
France	La Rose Blanche Paris	Personal Care	Cosmetics & Personal Care
France	Laboratoire les 3 CHENES	Medicine	Medicine
France	Lancel	Clothing	Textiles
France	Lancome	Personal Care	Cosmetics & Personal Care
France	Laura Mercier	Personal Care	Cosmetics & Personal Care
France	Ledger SAS	Manufacturing	Instrumentation
France	L'oreal	Personal Care	Cosmetics & Personal Care
France	MARIA GALLAND GmbH	Personal Care	Cosmetics & Personal Care
France	Millet Mountain Group	Clothing	Textiles
France	Nailmatic Kids	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
France	Nanobacterie	Medicine	Medicine
France	Nanobiotix	Medicine	Medicine
France	Nawa Technologies	Manufacturing	Energy
France	Novasep	Manufacturing	Home, Garden, Environment
France	Orlane	Personal Care	Cosmetics & Personal Care
France	Orsay Physics	Manufacturing	Instrumentation
France	OZ Biosciences	Medicine	Medicine
France	Phytomer	Personal Care	Cosmetics & Personal Care
France	Rdnano	Manufacturing	Coatings, Paints, sealants
France	RéVive	Personal Care	Cosmetics & Personal Care
France	Riber	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
France	Roudière	Clothing	Textiles
France	Saint-Gobain Glass	Construction	Constructions
France	Sanofi S.A.	Medicine	Medicine
France	Sephora	Personal Care	Cosmetics & Personal Care
France	Shark Helmets	Personal Care	Clothing & Personal Equipment
France	Smart Force Technologies	Manufacturing	Instrumentation
France	Soitec	Manufacturing	Instrumentation
France	STIL	Analysis	Instrumentation
France	Surfactis Technologies	Manufacturing	Coatings, Paints, sealants
France	Tefal	Home Care	Home, Garden, Environment
France	TEKNIMED	Medicine	Medicine

Country	Organisation	Category	Sector
France	TEQOYA	Manufacturing	Home, Garden, Environment
France	Tribotechnic	Manufacturing	Lithography & Printing
France	Valmont	Personal Care	Cosmetics & Personal Care
France	Veolia Water Technologies	Manufacturing	Home, Garden, Environment
France	Xenocs	Manufacturing	Instrumentation
France	Yves Saint Laurent	Clothing	Textiles
Germany	aap Implantate AG	Medicine	Medicine
Germany	Abberior Instruments	Analysis	Instrumentation
Germany	abc Technology International GmbH	Home care	Home, Garden, Environment
Germany	ABOS Handel Beier & Schulte GbR	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	ABUS	Home care	Home, Garden, Environment
Germany	ACI Laser	Manufacturing	Instrumentation
Germany	ACST GmbH	Manufacturing	Instrumentation
Germany	Across Barriers	Medicine	Medicine
Germany	Adekema	Automotive	Aerospace & Automotive
Germany	adidas Group	Clothing	Textiles
Germany	Adinotec AG	Construction	Constructions
Germany	ADVA Optical Networking	Manufacturing	Instrumentation
Germany	Aeterna Zentaris	Medicine	Medicine
Germany	Aixtron	Instrumentation	Lithography & Printing
Germany	Akemi	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	AkzoNobel Deco GmbH	Home care	Coatings, Paints, sealants
Germany	Alberto	Clothing	Textiles
Germany	Alfred Kärcher SE & Co. KG	Automotive	Aerospace & Automotive
Germany	Alpha Energy Storage Solution Co., Ltd	Manufacturing	Energy
Germany	Alphasoil technical solutions GmbH	Construction	Home, Garden, Environment
Germany	AMO	Fabrication	Lithography & Printing
Germany	AMO GmbH	Manufacturing	Instrumentation
Germany	Analytik Jena	Analysis	Instrumentation
Germany	Anfatec Instruments	Analysis	Instrumentation
Germany	Annemarie Borlind	Personal care	Cosmetics & Personal Care
Germany	ApaCare	Medicine	Medicine

Country	Organisation	Category	Sector
Germany	AppliChem GmbH	Personal care	Cosmetics & Personal Care
Germany	AQUANOVA AG	Personal care	Cosmetics & Personal Care
Germany	Armbruster Handelsgesellschaft mbH	Home care	Coatings, Paints, sealants
Germany	ARODI nanotechnology	Construction	Constructions
Germany	ARTOSS GmbH	Manufacturing	Medicine
Germany	ASIX GmbH	Home care	Home, Garden, Environment
Germany	Asmec Advanced Surface Mechanics	Instrumentation	Coatings, Paints, sealants
Germany	Atotech	Manufacturing	Coatings, Paints, sealants
Germany	Attocube Systems	Analysis	Instrumentation
Germany	Augsburg GmbH	Construction	Constructions
Germany	Aurion	Instrumentation	Lithography & Printing

Country	Organisation	Category	Sector
Germany	autonano	Automotive	Coatings, Paints, sealants
Germany	Autosol	Automotive	Coatings, Paints, sealants
Germany	AVANCIS GmbH	Manufacturing	Energy
Germany	AWN	Automotive	Coatings, Paints, sealants
Germany	Axo Dresden	Manufacturing	Lithography & Printing
Germany	AZUR SPACE Solar Power GmbH	Renewable Energies	Energy
Germany	B. Braun Melsungen AG	Medicine	Medicine
Germany	B.Richi	Home care	Textiles
Germany	B+W	Manufacturing	Clothing & Personal Equipment
Germany	Babista	Clothing	Textiles
Germany	Bama	Automotive	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	BASF	Construction	Constructions
Germany	Bauknecht Hausgeräte GmbH	Manufacturing	Home, Garden, Environment
Germany	Bayer HealthCare Pharmaceuticals Inc.	Medicine	Medicine
Germany	Beiersdorf AG	Personal care	Cosmetics & Personal Care
Germany	Bielmeier Hausgeräte GmbH	Manufacturing	Home, Garden, Environment
Germany	Bio-clean-pure GmbH	Construction	Coatings, Paints, sealants
Germany	BioFluidix GmbH	Manufacturing	Lithography & Printing
Germany	biomers.net GmbH	Manufacturing	Polymers
Germany	Bioni CS	Manufacturing	Coatings, Paints, sealants
Germany	Biontex	Medicine	Instrumentation

Country	Organisation	Category	Sector
Germany	Blomberg	Manufacturing	Home, Garden, Environment
Germany	bluechemGROUP	Automotive	Coatings, Paints, sealants
Germany	Blum-Novotest, Inc.	Manufacturing	Instrumentation
Germany	BMW	Automotive	Coatings, Paints, sealants
Germany	Böker	Home care	Home, Garden, Environment
Germany	Boraident	Manufacturing	Lithography & Printing
Germany	Bosch	Personal care	Clothing & Personal Equipment
Germany	Bruker AXS	Analysis	Instrumentation
Germany	Bübchen	Personal care	Cosmetics & Personal Care
Germany	Bürkert Fluid Control Systems	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Germany	CamoClean	Home care	Textiles
Germany	Caparol	Construction	Coatings, Paints, sealants
Germany	Captain Reents GmbH	Home care	Coatings, Paints, sealants
Germany	Caramba	Automotive	Coatings, Paints, sealants
Germany	Cardesign & Care Furtne	Automotive	Coatings, Paints, sealants
Germany	Carl Meiser GmbH & Co.KG	Manufacturing	Coatings, Paints, sealants
Germany	CCM	Manufacturing	Coatings, Paints, sealants
Germany	CCM GmbH	Manufacturing	Coatings, Paints, sealants
Germany	cc-NanoBioNet e.V.	Manufacturing	Toys
Germany	CemeCon	Manufacturing	Coatings, Paints, sealants
Germany	CeNano GmbH & Co. KG	Clothing	Textiles

Country	Organisation	Category	Sector
Germany	Cerax	Sports & Fitness	Coatings, Paints, sealants
Germany	Certiman	Automotive	Coatings, Paints, sealants
Germany	Cetelon Nanotechnik	Manufacturing	Coatings, Paints, sealants
Germany	Cetelon Nanotechnik GmbH	Construction	Constructions
Germany	Chemicell	Medicine	Instrumentation
Germany	Cleancorp NanoCoatings, Paints, sealants	Manufacturing	Coatings, Paints, sealants
Germany	CleanglaS	Automotive	Coatings, Paints, sealants
Germany	Clinan Deutschland	Home care	Home, Garden, Environment
Germany	Clou	Home care	Coatings, Paints, sealants
Germany	CODIXX	Manufacturing	Energy
Germany	Collonil	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	colorNdrive UG	Automotive	Coatings, Paints, sealants
Germany	Confovis	Analysis	Instrumentation
Germany	Continental	Manufacturing	Clothing & Personal Equipment
Germany	Cool Chips plc	Manufacturing	Instrumentation
Germany	COTEC	Manufacturing	Coatings, Paints, sealants
Germany	Covestro Ltd.	Manufacturing	Aerospace & Automotive
Germany	Cozari	Home care	Coatings, Paints, sealants
Germany	création	Clothing	Textiles
Germany	Creation Direkt international GmbH	Home care	Home, Garden, Environment
Germany	Creation L	Clothing	Textiles
Germany	CrystalTech Nano	Personal care	Textiles

Country	Organisation	Category	Sector
Germany	CTC Nanotechnology GmbH	Construction	Constructions
Germany	da Vinci Brushes	Personal care	Clothing & Personal Equipment
Germany	DAHLE	Manufacturing	Home, Garden, Environment
Germany	D-Coat GmbH	Manufacturing	Coatings, Paints, sealants
Germany	Deb Group Ltd.	Medicine	Medicine
Germany	Decathlon	Clothing	Clothing & Personal Equipment
Germany	DeFraWater GmbH	Manufacturing	Home, Garden, Environment
Germany	Deichmann	Home care	Home, Garden, Environment
Germany	DENNERLE	Agricutlure	Home, Garden, Environment

Country	Organisation	Category	Sector
Germany	DENTAID GmbH	Medicine	Medicine
Germany	Der Automobilputzer	Automotive	Coatings, Paints, sealants
Germany	Dermaviduals	Personal care	Cosmetics & Personal Care
Germany	Deutsche Nano LiquiTec, GmbH	Manufacturing	Energy
Germany	Deutsche Steinzeug Cremer & Breuer AG	Construction	Constructions
Germany	Die NANO EXPERTEN GmbH	Home care	Home, Garden, Environment
Germany	Dietz	Sports & Fitness	Home, Garden, Environment
Germany	Dirk Rossmann GmbH	Home care	Textiles
Germany	Dm-drogerie markt GmbH	Personal care	Cosmetics & Personal Care
Germany	DME Scanning Probe Microscopes	Analysis	Instrumentation
Germany	Dr. Baumann	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	Dr. Keddo	Automotive	Coatings, Paints, sealants
Germany	Dr. Rimpler GmbH	Personal care	Cosmetics & Personal Care
Germany	Dr. Wack	Automotive	Coatings, Paints, sealants
Germany	DREEBIT	Manufacturing	Instrumentation
Germany	Duke of Dubbin	Home care	Coatings, Paints, sealants
Germany	Dynafit	Clothing	Textiles
Germany	Edeka	Personal care	Cosmetics & Personal Care
Germany	Efalock	Personal care	Cosmetics & Personal Care
Germany	ELEKTROFORM	Manufacturing	Coatings, Paints, sealants
Germany	Elixir Strings	Manufacturing	Clothing & Personal Equipment
Germany	EMAG AG	Medicine	Medicine

Country	Organisation	Category	Sector
Germany	Emsal	Home care	Home, Garden, Environment
Germany	Endotherm Life Science Molecules	Medicine	Medicine
Germany	Endothermic fire protection	Construction	Coatings, Paints, sealants
Germany	Engineered nanoProducts Germany	Manufacturing	Coatings, Paints, sealants
Germany	EPG AG	Construction	Coatings, Paints, sealants
Germany	ERC	Petroleum	Aerospace & Automotive
Germany	ERC Additiv GmbH	Automotive	Aerospace & Automotive
Germany	Erdal	Personal care	Coatings, Paints, sealants
Germany	Erima	Clothing	Textiles
Germany	Erlus AG	Construction	Constructions
Germany	Ermila	Manufacturing	Clothing & Personal Equipment

Country	Organisation	Category	Sector
Germany	Eucerin	Personal care	Cosmetics & Personal Care
Germany	Ewabo Chemie	Manufacturing	Coatings, Paints, sealants
Germany	Excelitas	Manufacturing	Energy
Germany	Fair vital	Food & Feed	Food & Feed
Germany	Feldten Marine	Petroleum	Coatings, Paints, sealants
Germany	Fette Pharma AG	Personal care	Cosmetics & Personal Care
Germany	Feuerdepot GmbH	Home care	Home, Garden, Environment
Germany	FJ-TEC industrial supplies	Construction	Coatings, Paints, sealants
Germany	Focus	Analysis	Instrumentation
Germany	Forschungszentrum Jülich	Manufacturing	Instrumentation
Germany	Frankenstolz	Home care	Textiles

Country	Organisation	Category	Sector
Germany	Frankfurt Laser Company	Manufacturing	Instrumentation
Germany	Fresenius Kabi	Medicine	Medicine
Germany	Fritsch	Analysis	Instrumentation
Germany	FRITZ HILTL HOSENFABRIK GMBH & CO. KG	Clothing	Textiles
Germany	Galderma Laboratory GmbH	Personal care	Cosmetics & Personal Care
Germany	GATTAquant	Analysis	Instrumentation
Germany	GEA Group	Manufacturing	Home, Garden, Environment
Germany	Geo-Versand	Manufacturing	Home, Garden, Environment
Germany	Global Prefer	Automotive	Coatings, Paints, sealants
Germany	GMT Membrantechnik GmbH	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Germany	Gollit Autopflege	Automotive	Coatings, Paints, sealants
Germany	Greenerity GmbH	Manufacturing	Energy
Germany	Grimm Aerosol Technik	Manufacturing	Instrumentation
Germany	Grünbeck Wasseraufbereitung GmbH	Manufacturing	Home, Garden, Environment
Germany	Grundig Intermedia GmbH	Manufacturing	Home, Garden, Environment
Germany	Hager & Werken GmbH & Co. KG	Personal care	Cosmetics & Personal Care
Germany	Hannes Pharma	Food & Feed	Food & Feed
Germany	Hardy	Sports & Fitness	Clothing & Personal Equipment
Germany	Head	Sports & Fitness	Clothing & Personal Equipment
Germany	Health Air Technology GmbH	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Germany	HECO	Home care	Instrumentation
Germany	Heidelberg Instruments Mikrotechnik	Manufacturing	Lithography & Printing
Germany	HeidelbergCement AG	Construction	Constructions
Germany	HeinzBikes	Manufacturing	Instrumentation
Germany	Held biker fashion	Clothing	Textiles
Germany	Helen Pietrulla Kosmetika	Personal care	Cosmetics & Personal Care
Germany	Heliatek	Energy	Energy
Germany	Heliatek GmbH	Manufacturing	Energy
Germany	Hemoteq	Manufacturing	Coatings, Paints, sealants
Germany	Henkel	Manufacturing	Coatings, Paints, sealants
Germany	Herbol	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Heureka Nano	Construction	Coatings, Paints, sealants
Germany	Hielscher Ultrasound Technology	Instrumentation	Instrumentation
Germany	Himipex Oil	Petroleum	Coatings, Paints, sealants
Germany	Hobutec GmbH	Manufacturing	Coatings, Paints, sealants
Germany	Hollingsworth & Vose	Manufacturing	Energy
Germany	Holmenkol GmbH	Personal care	Cosmetics & Personal Care
Germany	Höpner Lacke GmbH	Construction	Coatings, Paints, sealants
Germany	HOTREGA	Construction	Coatings, Paints, sealants
Germany	HuaShen EU International	Personal care	Cosmetics & Personal Care
Germany	IBZ - Salzchemie GmbH & Co. KG	Construction	Coatings, Paints, sealants
Germany	Impreglion	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Incoatec	Manufacturing	Coatings, Paints, sealants
Germany	Infineon	Electronics	Energy
Germany	Innolume	Electronics	Instrumentation
Germany	INNOWEP	Analysis	Instrumentation
Germany	Innowledgement	Manufacturing	Instrumentation
Germany	Inomat	Manufacturing	Coatings, Paints, sealants
Germany	InovisCoat	Manufacturing	Coatings, Paints, sealants
Germany	INTHERMO GmbH	Home care	Coatings, Paints, sealants
Germany	INVEX GmbH	Manufacturing	Home, Garden, Environment
Germany	Invisibobble	Personal care	Cosmetics & Personal Care
Germany	in vitro - Institut für Molekularbiologie	Medicine	Instrumentation

Country	Organisation	Category	Sector
Germany	Iontof	Analysis	Instrumentation
Germany	IRO Yachtsysteme	Sea	Coatings, Paints, sealants
Germany	Isabelle Lancray	Personal care	Cosmetics & Personal Care
Germany	ItN Nanovation AG	Manufacturing	Home, Garden, Environment
Germany	Jack Wolfskin	Clothing	Textiles
Germany	Jacques Britt Hemden und Blusen	Clothing	Textiles
Germany	Jenoptik	Manufacturing	Energy
Germany	JenLab	Medicine	Instrumentation
Germany	Jetter Automation	Manufacturing	Instrumentation
Germany	Joyona International Marketing Ltd	Personal care	Cosmetics & Personal Care
Germany	JPK Instruments	Analysis	Instrumentation

Country	Organisation	Category	Sector
Germany	Judith Williams	Clothing	Textiles
Germany	Kammrath & Weiss	Analysis	Instrumentation
Germany	Kern Micro- und Feinwerktechnik	Manufacturing	Instrumentation
Germany	Kerona GmbH	Automotive	Coatings, Paints, sealants
Germany	Kexel	Manufacturing	Coatings, Paints, sealants
Germany	Kiwi	Home care	Coatings, Paints, sealants
Germany	KLAPP COSMETICS GMBH	Personal care	Cosmetics & Personal Care
Germany	Kleindiek Nanotechnik	Manufacturing	Energy
Germany	Kleindiek Nanotechnik GmbH	Manufacturing	Instrumentation
Germany	Klenax	Construction	Coatings, Paints, sealants
Germany	Klocke Nanotechnik	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Germany	Koch-Chemie GmbH	Automotive	Coatings, Paints, sealants
Germany	Kornbusch & Startin	Home care	Textiles
Germany	Koso	Manufacturing	Instrumentation
Germany	Krause Maschinenbau	Manufacturing	Instrumentation
Germany	Kruss	Instrumentation	Instrumentation
Germany	LAMSYSTEMS CC	Medicine	Instrumentation
Germany	Landshut Lackfabrik	Construction	Coatings, Paints, sealants
Germany	Landshuter Lackfabrik GmbH	Manufacturing	Coatings, Paints, sealants
Germany	LANXESS Deutschland GmbH	Automotive	Coatings, Paints, sealants
Germany	LayTec	Instrumentation	Coatings, Paints, sealants
Germany	LayTec AG	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Germany	Leica Microsystems	Manufacturing	Instrumentation
Germany	Leitbild der Swd Lubricants GmbH & Co. KG	Automotive	Aerospace & Automotive
Germany	Lensspirit	Medicine	Clothing & Personal Equipment
Germany	LEYCO Wassertechnik GmbH	Manufacturing	Home, Garden, Environment
Germany	Lifelight	Personal care	Cosmetics & Personal Care
Germany	LIQUI MOLY GmbH	Petroleum	Aerospace & Automotive
Germany	LITHOFIN	Automotive	Coatings, Paints, sealants
Germany	Lithonplus GmbH & Co	Construction	Constructions
Germany	Livoa Vital	Food & Feed	Food & Feed
Germany	Lofec Flächenheizung	Medicine	Medicine
Germany	LOT-QuantumDesign	Analysis	Instrumentation

Country	Organisation	Category	Sector
Germany	LotusReady Nano-Tech Groß- & Einzelhandel	Automotive	Coatings, Paints, sealants
Germany	LR Health & Beauty Systems	Personal care	Cosmetics & Personal Care
Germany	LR HEALTH AND BEUTY SYSTEMS	Personal care	Cosmetics & Personal Care
Germany	LUM	Analysis	Instrumentation
Germany	Luther´s Kunststoff Center LKSSHOP	Automotive	Aerospace & Automotive
Germany	LymTal International	Construction	Coatings, Paints, sealants
Germany	M2 Beauté Cosmetics GmbH	Personal care	Cosmetics & Personal Care
Germany	M2-Automation	Medicine	Instrumentation
Germany	MagForce AG	Medicine	Medicine
Germany	Maloja	Clothing	Textiles
Germany	Malu Wilz	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	Manz AG	Manufacturing	Energy
Germany	Markilus	Home care	Textiles
Germany	Megadenta Dentalprodukte GmbH	Medicine	Medicine
Germany	Membran-Filtrations-Technik GmbH	Manufacturing	Home, Garden, Environment
Germany	Mercedes-Benz	Automotive	Coatings, Paints, sealants
Germany	merkel coatings	Automotive	Coatings, Paints, sealants
Germany	Micro Resist Technology	Manufacturing	Energy
Germany	Microtrac	Analysis	Instrumentation
Germany	Minox	Sports & Fitness	Clothing & Personal Equipment
Germany	MÜLLER TEXTIL GROUP	Manufacturing	Textiles
Germany	Multi Channel Systems	Medicine	Instrumentation

Country	Organisation	Category	Sector
Germany	Mykita	Personal care	Clothing & Personal Equipment
Germany	NADICO Technologie GmbH	Home care	Home, Garden, Environment
Germany	Nahrungsergänzung Naturcosmetik GmbH	Personal care	Cosmetics & Personal Care
Germany	Nano Parat	Automotive	Coatings, Paints, sealants
Germany	Nano Surface Solutions	Manufacturing	Coatings, Paints, sealants
Germany	Nano4Life	Home care	Home, Garden, Environment
Germany	NanoAnalytik	Analysis	Instrumentation
Germany	NanoAndMore	Instrumentation	Instrumentation
Germany	Nano-Beschichtungen	Construction	Coatings, Paints, sealants
Germany	NanoBone®	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	Nano-Care AG	Manufacturing	Coatings, Paints, sealants
Germany	Nano-Care Deutschland AG	Medicine	Textiles
Germany	NanoConcept	Manufacturing	Coatings, Paints, sealants
Germany	NANOCRAFT	Manufacturing	Constructions
Germany	nanodeck	Construction	Coatings, Paints, sealants
Germany	Nanofilm Technologie	Analysis	Coatings, Paints, sealants
Germany	NanoFocus	Instrumentation	Lithography & Printing
Germany	NanoFocus AG	Medicine	Medicine
Germany	Nanogate AG	Automotive	Aerospace & Automotive
Germany	Nanoinitiative Bayern GmbH	Manufacturing	Lithography & Printing
Germany	Nanolamina	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Nanolex Car Care	Automotive	Coatings, Paints, sealants
Germany	Nanoplus	Instrumentation	Instrumentation
Germany	nanoplus Nanosystems and Technologies GmbH	Manufacturing	Instrumentation
Germany	Nanopool	Manufacturing	Coatings, Paints, sealants
Germany	Nanoproofed	Manufacturing	Coatings, Paints, sealants
Germany	Nanoprotect	Manufacturing	Coatings, Paints, sealants
Germany	NanoScale Systems (Nanoss) GmbH	Manufacturing	Lithography & Printing
Germany	Nanoscribe	Fabrication	Lithography & Printing
Germany	NanoSys GmbH	Personal care	Cosmetics & Personal Care
Germany	NanoTemper	Medicine	Medicine
Germany	NanoTech Coatings, Paints, sealants	Manufacturing	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Nanotol	Construction	Coatings, Paints, sealants
Germany	NanoTools	Analysis	Instrumentation
Germany	Nanotrends	Medicine	Textiles
Germany	Nano-X	Manufacturing	Coatings, Paints, sealants
Germany	NANO-X GmbH	Construction	Constructions
Germany	Netzsch	Instrumentation	Instrumentation
Germany	Neufarm GmbH	Manufacturing	Home, Garden, Environment
Germany	NewPro	Construction	Coatings, Paints, sealants
Germany	NIGRIN NanoTec	Automotive	Coatings, Paints, sealants
Germany	NineLife	Medicine	Medicine
Germany	Novaled	Electronics	Energy

Country	Organisation	Category	Sector
Germany	NTC Nano Tech Coatings GmbH	Construction	Coatings, Paints, sealants
Germany	n-tec Gmbh	Manufacturing	Coatings, Paints, sealants
Germany	NTT NanoTech Coatings, Paints, sealants	Manufacturing	Coatings, Paints, sealants
Germany	Number One	Automotive	Coatings, Paints, sealants
Germany	Oberflächentechnik Preimeß GmbH	Manufacturing	Coatings, Paints, sealants
Germany	Oder Was Sonst	Automotive	Coatings, Paints, sealants
Germany	Oehlbach	Home care	Textiles
Germany	Oliver	Sports & Fitness	Clothing & Personal Equipment
Germany	OLYMP BEZNER KG	Clothing	Textiles
Germany	Olympus Soft Imaging Solutions	Analysis	Instrumentation
Germany	Onyx Coating GmbH	Manufacturing	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	OSMO Membrane Systems GmbH	Manufacturing	Home, Garden, Environment
Germany	Otto Keller	Manufacturing	Textiles
Germany	Owis	Manufacturing	Instrumentation
Germany	Qiagen	Medicine	Medicine
Germany	Palas Particle Technology	Manufacturing	Instrumentation
Germany	Panadur	Manufacturing	Coatings, Paints, sealants
Germany	Panasonic Healthcare Co., Ltd	Medicine	Medicine
Germany	Particle Metrix	Analysis	Instrumentation
Germany	PCI Augsburg GmbH	Construction	Constructions
Germany	Pedag	Automotive	Coatings, Paints, sealants
Germany	Percenta Nanotechnology	Manufacturing	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Perlprotect	Home care	Coatings, Paints, sealants
Germany	Permanon	Construction	Coatings, Paints, sealants
Germany	Pfeiffer Vacuum	Manufacturing	Energy
Germany	Physik Instrmente	Manufacturing	Instrumentation
Germany	PicoQuant	Manufacturing	Instrumentation
Germany	Piezosystem Jena	Manufacturing	Instrumentation
Germany	PlasmaChem GmbH	Petroleum	Aerospace & Automotive
Germany	Plasmatreat	Manufacturing	Coatings, Paints, sealants
Germany	Porotec	Analysis	Instrumentation
Germany	Portwell, Inc	Manufacturing	Instrumentation
Germany	Postnova Analytics GmbH	Petroleum	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	Prodima nanotec	Automotive	Coatings, Paints, sealants
Germany	Proidee	Manufacturing	Textiles
Germany	PURRATIO AG	Construction	Coatings, Paints, sealants
Germany	Raith	Manufacturing	Lithography & Printing
Germany	Rameder Anhängerkupplungen und Autoteile GmbH	Automotive	Coatings, Paints, sealants
Germany	RAS AG	Medicine	Medicine
Germany	Ratiopharm GmbH	Medicine	Food & Feed
Germany	Rauschert Distribution GmbH	Manufacturing	Home, Garden, Environment
Germany	R-dental Dentalerzeugnisse GmbH	Medicine	Medicine
Germany	REMA TIP TOP	Automotive	Aerospace & Automotive
Germany	REWITEC	Manufacturing	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Germany	ROCCAT	Personal care	Clothing & Personal Equipment
Germany	Roeckl Sporthandschuhe GmbH	Clothing	Textiles
Germany	Rohrer & Klingner Leipzig-Co.	Manufacturing	Lithography & Printing
Germany	Rono	Clothing	Textiles
Germany	Rowenta	Personal care	Cosmetics & Personal Care
Germany	Ruck-Zuck-Versand GmbH	Clothing	Textiles
Germany	Sachtleben	Food & Feed	Food & Feed
Germany	Sailfish	Clothing	Textiles
Germany	Sambol IBS GmbH	Home care	Textiles
Germany	Sandoz AG	Medicine	Medicine
Germany	Sangui Biotech GmbH	Personal care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Germany	Scandiccare	Home care	Coatings, Paints, sealants
Germany	Schaefer Technologie	Analysis	Instrumentation
Germany	SCHUETTEC	Automotive	Coatings, Paints, sealants
Germany	Schuhmacher Naturprodukte	Personal care	Cosmetics & Personal Care
Germany	Schwalbe	Sports & Fitness	Clothing & Personal Equipment
Germany	SENTECH Instruments	Analysis	Instrumentation
Germany	Shoeboys	Clothing	Coatings, Paints, sealants
Germany	Sikkens	Construction	Coatings, Paints, sealants
Germany	SilberSchutz	Clothing	Textiles
Germany	SILVERIUM LTD. & Co. KG	Construction	Coatings, Paints, sealants
Germany	Sios Messtechnik	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Germany	SmarAct	Manufacturing	Instrumentation
Germany	SmartMembranes GmbH	Manufacturing	Home, Garden, Environment
Germany	SolarWorld Industries GmbH	Manufacturing	Energy
Germany	Solibro GmbH	Manufacturing	Energy
Germany	Solitaire	Home care	Home, Garden, Environment
Germany	Solution Hunchback	Automotive	Coatings, Paints, sealants
Germany	SONAX GmbH	Automotive	Coatings, Paints, sealants
Germany	Spectro	Analysis	Instrumentation
Germany	Stada Medicines AG	Medicine	Cosmetics & Personal Care
Germany	Staedtler	Manufacturing	Clothing & Personal Equipment

Country	Organisation	Category	Sector
Germany	STOE	Analysis	Instrumentation
Germany	Struers	Analysis	Instrumentation
Germany	Surface	Instrumentation	Instrumentation
Germany	Suss MicroTec	Manufacturing	Instrumentation
Germany	SUSS MicroTec Group	Manufacturing	Lithography & Printing
Germany	Sympatec	Analysis	Instrumentation
Germany	Team Nanotec	Analysis	Instrumentation
Germany	Teka Group	Manufacturing	Home, Garden, Environment
Germany	Temicon	Manufacturing	Energy
Germany	Testo	Analysis	Instrumentation
Germany	TEXAMED® GmbH	Medicine	Textiles

Country	Organisation	Category	Sector
Germany	TK Sports GmbH	Sport & Fitness	Clothing & Personal Equipment
Germany	Tondeo	Personal care	Clothing & Personal Equipment
Germany	ttz Bremerhaven Am Lunedeich	Manufacturing	Food & Feed
Germany	uvex safety	Medicine	Medicine
Germany	VacSol GmbH	Manufacturing	Energy
Germany	VCM Morgenthaler GmbH	Home care	Instrumentation
Germany	Viabioano	Food & Feed	Food & Feed
Germany	Vileda	Medicine	Textiles
Germany	ViscoTec	Manufacturing	Lithography & Printing
Germany	Vistec Electron Beam	Manufacturing	Lithography & Printing
Germany	VitroCell	Medicine	Medicine

Country	Organisation	Category	Sector
Germany	Wacor GmbH	Manufacturing	Home, Garden, Environment
Germany	Walbusch Walter Busch GmbH & Co	Clothing	Textiles
Germany	Wella	Personal care	Cosmetics & Personal Care
Germany	Wenko-Wenselaar GmbH & Co. KG	Home care	Home, Garden, Environment
Germany	Westfalia Wergzeugcompany GmbH & CO KG	Manufacturing	Home, Garden, Environment
Germany	Wilpeg GmbH	Home care	Home, Garden, Environment
Germany	WITec	Analysis	Instrumentation
Germany	WMF	Home care	Home, Garden, Environment
Germany	Wolfgruben Werke	Construction	Coatings, Paints, sealants
Germany	Wunderlich GmbH & Co	Home care	Textiles

Country	Organisation	Category	Sector
Germany	Xantec Bioanalytics	Medicine	Instrumentation
Germany	Yachtcare	Construction	Coatings, Paints, sealants
Germany	Yachticon	Construction	Coatings, Paints, sealants
Germany	Zell-Kontakt	Medicine	Medicine
Germany	Zero	Home care	Coatings, Paints, sealants
Greece	AgriLife	Manufacturing	Home, Garden, Environment
Greece	Bauer	Construction	Coatings, Paints, sealants
Greece	BFP hellas	Manufacturing	Energy
Greece	Brite Hellas S.A.	Manufacturing	Energy
Greece	DMP DENTAL INDUSTRY S.A.	Medicine	Medicine
Greece	DUROSTICK	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Greece	Evomat A.E.	Construction	Constructions
Greece	Leather Care Products	Manufacturing	Coatings, Paints, sealants
Greece	NANO4LIFE EUROPE L.P.	Automotive	Coatings, Paints, sealants
Greece	nanoblo	Manufacturing	Coatings, Paints, sealants
Greece	NanoPhos	Manufacturing	Coatings, Paints, sealants
Hungary	Genetic Immunity	Medicine	Medicine
Hungary	Graboplast Ltd.	Construction	Constructions
Hungary	Nanobakt Kft.	Manufacturing	Home, Garden, Environment
Hungary	Nanosept	Manufacturing	Home, Garden, Environment
Hungary	Technoorg Linda	Analysis	Instrumentation
Hungary	ThalesNano	Analysis	Instrumentation

Country	Organisation	Category	Sector
Hungary	Wolf Chemicals Ltd.	Automotive	Coatings, Paints, Sealants
Hungary	wormy™	Sport & Fitness	Clothing & Personal Equipment
Ireland	ALKERMES PHARMA IRELAND LIMITED	Medicine	Medicine
Ireland	Allergan plc	Medicine	Medicine
Ireland	Biosensia	Medicine	Instrumentation
Ireland	Cellix	Medicine	Instrumentation
Ireland	Elan Pharma International Ltd.	Medicine	Medicine
Ireland	Horseware Ireland	Clothing	Textiles
Ireland	IndulgeMe	Medicine	Medicine
Ireland	Kastus®	Home care	Coatings, Paints, sealants
Ireland	NanoMagic	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Ireland	NANOTERA GROUP	Manufacturing	Home, Garden, Environment
Ireland	Particular Sciences	Analysis	Instrumentation
Ireland	Perrigo	Medicine	Instrumentation
Ireland	Pfizer Ireland Pharmaceuticals	Medicine	Medicine
Ireland	Schering Plough (Brinny) Co.	Medicine	Medicine
Ireland	Spraybase	Manufacturing	Instrumentation
Italy	3T	Sports & Fitness	Clothing & Personal Equipment
Italy	A.P.E. Research	Analysis	Instrumentation
Italy	ALFAPARF Milano	Personal Care	Cosmetics & Personal Care
Italy	Alpinestars	Clothing	Textiles
Italy	Arpa Industriale S.p.A.	Construction	Coatings, Paints, sealants

Country	Organisation	Category	Sector
Italy	Artsana S.p.a	Medicine	Medicine
Italy	BaByliss	Personal Care	Cosmetics & Personal Care
Italy	Barbierie	Automotive	Aerospace & Automotive
Italy	Bialetti	Home care	Home, Garden, Environment
Italy	Biotec srl	Medicine	Medicine
Italy	Blizzard	Clothing	Textiles
Italy	Camp	Clothing	Clothing & Personal Equipment
Italy	Castellani	Clothing	Textiles
Italy	Castelli Cycling	Clothing	Textiles
Italy	Centro Elettrotecnico Sperimentale Italiano Company	Manufacturing	Energy

Country	Organisation	Category	Sector
Italy	CHIESI Farmaceutici S.p.A.	Medicine	Medicine
Italy	COFRA S.r.l.	Clothing	Textiles
Italy	Cr.E.S.T. - Crisel Elettrooptical Systems Technology	Analysis	Instrumentation
Italy	Cressi	Sports & Fitness	Clothing & Personal Equipment
Italy	Cynergi Holding S.A.	Petroleum	Aerospace & Automotive
Italy	Dainese	Clothing	Textiles
Italy	Dermedical Skin Sciences	Personal Care	Cosmetics & Personal Care
Italy	Diadora	Clothing	Textiles
Italy	Directa Plus	Food & Feed	Food & Feed
Italy	EDILTECO S.P.A.	Construction	Constructions

Country	Organisation	Category	Sector
Italy	Elite	Sports & Fitness	Clothing & Personal Equipment
Italy	Estremo International	Petroleum	Aerospace & Automotive
Italy	Flonal spa	Home care	Home, Garden, Environment
Italy	FSA Full Speed Ahead	Sports & Fitness	Clothing & Personal Equipment
Italy	Immagina Biotechnology	Medicine	Medicine
Italy	Gamma Più	Personal Care	Cosmetics & Personal Care
Italy	Giordana	Clothing	Textiles
Italy	Giorgio Armani	Personal Care	Cosmetics & Personal Care
Italy	Graphene-XT	Manufacturing	Coatings, Paints, sealants
Italy	Hydor	Home care	Home, Garden, Environment

Country	Organisation	Category	Sector
Italy	Idropan Dell'Orto Depuratori srl Water	Manufacturing	Home, Garden, Environment
Italy	Iterchimica S.r.l.	Construction	Constructions
Italy	J-Teck3	Manufacturing	Lithography & Printing
Italy	Kenosistec	Manufacturing	Instrumentation
Italy	Klindex srl	Construction	Coatings, Paints, sealants
Italy	Klopman International	Clothing	Textiles
Italy	Kolzer	Manufacturing	Instrumentation
Italy	La Sportiva	Clothing	Textiles
Italy	Laviosa Chimica Mineraria SpA	Manufacturing	Polymers
Italy	Linary Nanotech	Medicine	Instrumentation
Italy	Mares	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Italy	Mentos	Food & Feed	Food & Feed
Italy	MOMODESIGN S.R.L.	Sports & Fitness	Clothing & Personal Equipment
Italy	Muchcolours	Manufacturing	Lithography & Printing
Italy	Nanoalps GmbH	Construction	Coatings, Paints, sealants
Italy	Nanotech	Manufacturing	Coatings, Paints, sealants
Italy	Nanotech Surface	Medicine	Medicine
Italy	Nanto Paint Bio Green	Manufacturing	Coatings, Paints, sealants
Italy	Percenta Europe Ltd.	Manufacturing	Home, Garden, Environment
Italy	Prodotti Arca S.r.l.	Manufacturing	Home, Garden, Environment
Italy	Silicon Biosystems	Medicine	Instrumentation

Country	Organisation	Category	Sector
Italy	Silvia Osteo	Food & Feed	Food & Feed
Italy	Solargenome	Personal Care	Energy
Italy	Tempco srl	Manufacturing	Energy
Italy	Tethis	Manufacturing	Coatings, Paints, sealants
Italy	Tucano Urbano	Clothing	Textiles
Italy	Vittoria S.p.A,	Automotive	Aerospace & Automotive
Italy	Xenia Materials	Manufacturing	Coatings, Paints, sealants
Latvia	BINATEC Inc.	Manufacturing	Coatings, Paints, Sealants
Latvia	Kinetics	Personal Care	Cosmetics & Personal Care
Liechtenstein	nanoFlowcell	Manufacturing	Energy
Lithuania	UAB Baltic Nano Technologies	Manufacturing	Coatings, Paints, Sealants

Country	Organisation	Category	Sector
Lithuania	Polirovka	Automotive	Coatings, Paints, Sealants
Lithuania	nanoPro Solutions Ltd.	Manufacturing	Home, Garden, Environment
Lithuania	Medicinos Linija UAB	Medicine	Medicine
Lithuania	NanoAvionics	Manufacturing	Energy
Lithuania	NanoLandBaltic	Manufacturing	Home, Garden, Environment
Lithuania	PRO-TEC BALTIJA	Petroleum	Aerospace & Automotive
Luxembourg	MPG Molecular Plasma Group	Manufacturing	Lithography & Printing
Netherlands	AkzoNobel N.V.	Automotive	Aerospace & Automotive
Netherlands	Applied Nanolayers	Manufacturing	Instrumentation
Netherlands	Aquamarijn	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Netherlands	Aqua-Tropica	Manufacturing	Home, Garden, Environment
Netherlands	ASM International	Manufacturing	Instrumentation
Netherlands	ASML	Manufacturing	Lithography & Printing
Netherlands	Avantes	Analysis	Instrumentation
Netherlands	Bataleon	Sport & Fitness	Clothing & Personal Equipment
Netherlands	BBB	Manufacturing	Home, Garden, Environment
Netherlands	Chemona Holding B.V.	Manufacturing	Coatings, Paints, Sealants
Netherlands	Chemona NanoCoat Technologies	Construction	Coatings, Paints, Sealants
Netherlands	CPS Instruments Europe	Analysis	Instrumentation
Netherlands	Crucell	Medicine	Medicine

Country	Organisation	Category	Sector
Netherlands	DELMIC	Analysis	Instrumentation
Netherlands	DENSsolutions	Analysis	Instrumentation
Netherlands	DSM Somos	Manufacturing	Coatings, Paints, Sealants
Netherlands	EAT NANO	Food & Feed	Food & Feed
Netherlands	FRAmelco	Manufacturing	Home, Garden, Environment
Netherlands	GCP Dental	Medicine	Medicine
Netherlands	Hi-Tec Sports Ltd	Clothing	Textiles
Netherlands	IME Technologies	Manufacturing	Instrumentation
Netherlands	Innovative Solutions In Space.	Manufacturing	Energy
Netherlands	Kriya Materials	Manufacturing	Coatings, Paints, Sealants
Netherlands	Lenntech Water Treatment & Air Purification	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Netherlands	Malvern Panalytical	Manufacturing	Instrumentation
Netherlands	Micronit	Medicine	Instrumentation
Netherlands	Morphotonics	Manufacturing	Lithography & Printing
Netherlands	MyLife Technologies	Medicine	Instrumentation
Netherlands	Mystic	Personal Care	Textiles
Netherlands	Nanocoating	Petroleum	Coatings, Paints, Sealants
Netherlands	Nanospray	Manufacturing	Coatings, Paints, Sealants
Netherlands	Nearfield Instruments	Analysis	Instrumentation
Netherlands	NXFiltration	Manufacturing	Home, Garden, Environment
Netherlands	NXP	Manufacturing	Instrumentation
Netherlands	O'NEILL	Clothing	Textiles

Country	Organisation	Category	Sector
Netherlands	Pentair	Manufacturing	Home, Garden, Environment
Netherlands	Philips	Manufacturing	Instrumentation
Netherlands	Pro Kennex	Sport & Fitness	Clothing & Personal Equipment
Netherlands	ProNano	Automotive	Aerospace & Automotive
Netherlands	Royal republiq	Clothing	Textiles
Netherlands	RSS NanoCoatings BV	Construction	Coatings, Paints, Sealants
Netherlands	Sibel	Personal Care	Clothing & Personal Equipment
Netherlands	Sikkens	Automotive	Coatings, Paints, Sealants
Netherlands	Silver-Nano Face Masks	Personal Care	Clothing & Personal Equipment
Netherlands	Solmates	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Netherlands	The Health Factory	Food & Feed	Food & Feed
Netherlands	Viroclinics Xplore	Medicine	Medicine
Netherlands	Voltea	Manufacturing	Home, Garden, Environment
Netherlands	Vossen Laboratories Group	Manufacturing	Coatings, Paints, Sealants
Netherlands	VSParticle	Manufacturing	Instrumentation
Norway	CrayoNano	Manufacturing	Energy
Norway	Desert Control LNC	Manufacturing	Home, Garden, Environment
Norway	Graphene Batteries	Manufacturing	Energy
Norway	Helly Hansen	Clothing	Textiles
Norway	Hydrophobia Nano Coating	Manufacturing	Coatings, Paints, Sealants
Norway	Joma International AS	Manufacturing	Coatings, Paints, Sealants

Country	Organisation	Category	Sector
Norway	Madshus	Sport & Fitness	Textiles
Norway	Norrona	Clothing	Textiles
Norway	Novelda	Manufacturing	Energy
Norway	Prox Dynamics AS	Manufacturing	Home, Garden, Environment
Norway	Re-Turn AS	Sport & Fitness	Coatings, Paints, Sealants
Norway	Sweet Protection	Clothing	Textiles
Norway	Swix	Sport & Fitness	Coatings, Paints, Sealants
Poland	Agro Nanotechnology Corporation	Manufacturing	Home, Garden, Environment
Poland	Bielenda Kosmetyki Naturalne	Personal Care	Cosmetics & Personal Care
Poland	Dartmoor	Automotive	Aerospace & Automotive
Poland	Dr Irena Eris	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
Poland	Kajner Hungrian canoe kayak paddles	Sports & Fitness	Clothing & Personal Equipment
Poland	KREISEL Technika Budowlana	Construction	Coatings, Paints, Sealants
Poland	Nano Koloid	Medicine	Medicine
Poland	NanoAuto	Automotive	Aerospace & Automotive
Poland	nanoBeauty	Personal Care	Cosmetics & Personal Care
Poland	NANOBIZ.PL Ltd.	Manufacturing	Coatings, Paints, Sealants
Poland	Nanoformula s.c. (Nano Ceramic Protect®)	Manufacturing	Coatings, Paints, Sealants
Poland	NanoSync Sp. z o.o.	Manufacturing	Polymers
Poland	NOVASCON PHARMACEUTICALS	Medicine	Medicine
Poland	P.W. ALPOL	Construction	Constructions
Poland	PODOPHARM Sp. z o.o.	Medicine	Medicine

Country	Organisation	Category	Sector
Poland	Pro Aktiv	Personal Care	Cosmetics & Personal Care
Poland	Raypath	Manufacturing	Textiles
Poland	Saule Technologies	Manufacturing	Energy
Poland	SGX Sensortech	Manufacturing	Home, Garden, Environment
Poland	TENZI Sp. z o. o.	Automotive	Aerospace & Automotive
Poland	VINSVIN Sp. z oo, Sp. k	Personal Care	Cosmetics & Personal Care
Poland	Ziaja	Personal Care	Cosmetics & Personal Care
Portugal	Ceramed	Medicine	Medicine
Portugal	FLUIDINOVA, S.A.	Medicine	Medicine
Portugal	NanoPAINT	Manufacturing	Lithography & Printing
Romania	Infra Nano	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Slovakia	HELSKE LTD	Construction	Constructions
Slovakia	NanoProm s.r.o	Clothing	Textiles
Slovakia	Head	Sport & Fitness	Clothing & Personal Equipment
Spain	Advanced Nanotechnologies S.L.	Manufacturing	Coatings, Paints, Sealants
Spain	Aloe Vera Lanzarote	Personal Care	Cosmetics & Personal Care
Spain	Applynano Solutions	Manufacturing	Coatings, Paints, Sealants
Spain	APRIA Systems	Manufacturing	Home, Garden, Environment
Spain	Bactiblock	Manufacturing	Home, Garden, Environment
Spain	Balenciaga	Clothing	Textiles
Spain	Bioinicia	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Spain	BIONANOPLUS Pol	Medicine	Medicine
Spain	Cebiotex	Medicine	Medicine
Spain	CEMITEC	Manufacturing	Energy
Spain	CIDETE INGENIEROS SL	Manufacturing	Instrumentation
Spain	E.ECOLOGY s.l.	Manufacturing	Aerospace & Automotive
Spain	ENDOR TECHNOLOGIES	Medicine	Medicine
Spain	Graphenano Smart Materials	Construction	Constructions
Spain	Graphenstone Nanotechnology Coatings	Manufacturing	Coatings, Paints, Sealants
Spain	Ingeniatrics Technologies	Medicine	Instrumentation
Spain	Interprox	Personal Care	Cosmetics & Personal Care
Spain	Ioner	Analysis	Instrumentation

Country	Organisation	Category	Sector
Spain	IZASA SCIENTIFIC, SLU	Medicine	Medicine
Spain	Kimitec Group	Manufacturing	Home, Garden, Environment
Spain	Nadetech	Manufacturing	Instrumentation
Spain	NanoBioMatters Industries S.L	Food & Feed	Food & Feed
Spain	NANOGAP SUB-NM-POWDER, S.A.	Manufacturing	Lithography & Printing
Spain	Nanoimmunotech	Medicine	Medicine
Spain	Nanovex Biotechnologies	Medicine	Medicine
Spain	Nanomateriales y Polimeros, S.L.	Medicine	Medicine
Spain	nB nanoScale Biomagnetics	Analysis	Instrumentation
Spain	ONYX SOLAR ENERGY S.L.	Manufacturing	Energy
Spain	PCE Instruments	Analysis	Instrumentation

Country	Organisation	Category	Sector
Spain	RAMEM	Analysis	Instrumentation
Spain	Sensofar	Analysis	Instrumentation
Spain	Sesderma	Personal Care	Cosmetics & Personal Care
Spain	Sgenia	Manufacturing	Energy
Spain	Tarrago Brands International	Manufacturing	Coatings, Paints, Sealants
Spain	TECNAN Tecnología Navarra de Nanoproductos S.L.	Petroleum	Coatings, Paints, Sealants
Spain	TOLSA	Manufacturing	Polymers
Spain	Twinstar Iberica	Manufacturing	Home, Garden, Environment
Spain	Ufesa	Personal Care	Cosmetics & Personal Care
Spain	Yflow	Manufacturing	Instrumentation
Sweden	AddBio AB	Medicine	Medicine

Country	Organisation	Category	Sector
Sweden	Affibody Medical AB	Medicine	Medicine
Sweden	Ångström Aerospace Corporation	Manufacturing	Instrumentation
Sweden	APC Composite	Manufacturing	Polymers
Sweden	Applied Nano Surfaces Sweden AB	Manufacturing	Coatings, Paints, Sealants
Sweden	AstraZeneca AB	Medicine	Medicine
Sweden	Attana AB	Manufacturing	Instrumentation
Sweden	Bactiguard AB	Medicine	Medicine
Sweden	Biolin Scientific	Analysis	Instrumentation
Sweden	Biopolymer Products of Sweden	Construction	Constructions
Sweden	Biora AB	Medicine	Medicine
Sweden	Biosensor Applications Sweden AB	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Sweden	Biotech AB	Manufacturing	Instrumentation
Sweden	Bohus Biotech AB	Medicine	Medicine
Sweden	Brilliant Smile Sweden AB	Medicine	Medicine
Sweden	Camargue	Manufacturing	Home, Garden, Energy
Sweden	Camurus AB	Medicine	Medicine
Sweden	Cellectricon AB	Medicine	Medicine
Sweden	ChromoGenics	Energy	Instrumentation
Sweden	Cline Scientific AB	Medicine	Medicine
Sweden	Cochlear Nordic AB	Manufacturing	Instrumentation
Sweden	Craft Sportswear	Clothing	Textiles
Sweden	Denator AB	Medicine	Medicine

Country	Organisation	Category	Sector
Sweden	DENTSPLY IH AB	Medicine	Medicine
Sweden	Doxa AB	Medicine	Medicine
Sweden	Dyenamo AB	Manufacturing	Energy
Sweden	Eka Chemicals	Home Care	Home, Garden, Energy
Sweden	Electrolux	Home Care	Home, Garden, Energy
Sweden	EPIC Travelgear	Personal Equipment	Clothing & Personal Equipment
Sweden	FineCell Sweden AB	Manufacturing	Polymers
Sweden	Fractal Design	Manufacturing	Home, Garden, Energy
Sweden	GE Healthcare Life Sciences	Medicine	Medicine
Sweden	Genovis	Medicine	Instrumentation
Sweden	glo	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Sweden	Graphensic AB	Manufacturing	Instrumentation
Sweden	Graphmatech AB	Petroleum	Lithography & Printing
Sweden	Gyros AB	Medicine	Medicine
Sweden	Haglöfs	Clothing	Textiles
Sweden	Hagmans Kemi AB	Construction	Coatings, Paints, Sealants
Sweden	Hammerglass AB	Construction	Constructions
Sweden	Hestra	Clothing	Textiles
Sweden	Imego AB	Manufacturing	Instrumentation
Sweden	Insplorion AB	Manufacturing	Instrumentation
Sweden	Integrum AB	Medicine	Medicine
Sweden	Lightlab Sweden AB	Manufacturing	Energy

Country	Organisation	Category	Sector
Sweden	MIP Technologies AB	Petroleum	Constructions
Sweden	Mycronic Sweden HQ	Manufacturing	Lithography & Printing
Sweden	Nanologica	Manufacturing	Chemicals
Sweden	Nanoxis AB	Medicine	Medicine
Sweden	NordAmps	Manufacturing	Instrumentation
Sweden	Nouryon	Manufacturing	Chemicals
Sweden	Novosense AB	Manufacturing	Instrumentation
Sweden	Oasmia Pharmaceutical AB	Medicine	Medicine
Sweden	Obducat	Manufacturing	Lithography & Printing
Sweden	Occlutech International AB	Medicine	Medicine
Sweden	Olink Bioscience AB	Medicine	Medicine

Country	Organisation	Category	Sector
Sweden	Pharmacia and Upjohn Company LLC	Medicine	Medicine
Sweden	Pinewood	Home Care	Home, Garden, Energy
Sweden	Point65	Personal Equipment	Clothing & Personal Equipment
Sweden	Polykemi AB	Home Care	Home, Garden, Energy
Sweden	Porenix AB	Manufacturing	Home, Garden, Energy
Sweden	PrimeBlade Sweden AB	Construction	Constructions
Sweden	Promimic AB	Medicine	Medicine
Sweden	Qunano	Manufacturing	Instrumentation
Sweden	QuNano AB	Manufacturing	Instrumentation
Sweden	RISE Acreo	Manufacturing	Instrumentation
Sweden	Sandvik Materials Technology	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Sweden	SECO Tools	Manufacturing	Constructions
Sweden	SenseAir	Manufacturing	Home, Garden, Energy
Sweden	SenSiC AB	Manufacturing	Home, Garden, Energy
Sweden	SHT Smart High Tech AB	Manufacturing	Polymers
Sweden	Silex Microsystems AB	Manufacturing	Instrumentation
Sweden	Smoltek	Manufacturing	Instrumentation
Sweden	Sol Voltaics	Manufacturing	Energy
Sweden	Sol Voltaics AB	Manufacturing	Energy
Sweden	Solid Gear Footwear	Clothing	Textiles
Sweden	SPAGO Nanomedical AB	Medicine	Medicine
Sweden	STIGA Sports AB	Sport & Fitness	Home & Personal Equipment

Country	Organisation	Category	Sector
Sweden	Sweden Nano Water AB	Manufacturing	Home, Garden, Energy
Sweden	Swedish Algae Factory	Manufacturing	Energy
Sweden	Swedish GTC AB	Manufacturing	Home, Garden, Energy
Sweden	Swedish Space Corporation	Aerospace	Aerospace & Automotive
Sweden	Verso Skincare	Personal Care	Cosmetics
Sweden	Wallenius Water AB	Manufacturing	Home, Garden, Energy
Sweden	Watersprint	Manufacturing	Home, Garden, Energy
Sweden	XCounter AB	Manufacturing	Instrumentation
Sweden	Xzero AB	Manufacturing	Home, Garden, Energy
Switzerland	Allen's	Food & Feed	Food & Feed
Switzerland	Alpes Lasers	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
Switzerland	Attolight	Analysis	Instrumentation
Switzerland	BMC Switzerland AG	Sport & Fitness	Clothing & Personal Equipment
Switzerland	BÜCHI Labortechnik AG	Medicine	Medicine
Switzerland	Bühler AG	Manufacturing	Coatings, Paints, Sealants
Switzerland	CANDULOR AG	Medicine	Medicine
Switzerland	Carnation Breakfast Essentials	Food & Feed	Food & Feed
Switzerland	Ceracoat	Manufacturing	Coatings, Paints, Sealants
Switzerland	COLTENE Group	Medicine	Medicine
Switzerland	Comet	Analysis	Instrumentation
Switzerland	Debiopharm Group	Medicine	Medicine
Switzerland	Debiotech	Medicine	Instrumentation

Country	Organisation	Category	Sector
Switzerland	Decentlab GmbH	Manufacturing	Home, Garden, Environment
Switzerland	Eulitha	Manufacturing	Lithography & Printing
Switzerland	FEMTOprint	Manufacturing	Instrumentation
Switzerland	FemtoTools	Analysis	Instrumentation
Switzerland	FLISOM Flexible Solar Modules	Manufacturing	Energy
Switzerland	Freshpoint	Food & Feed	Food & Feed
Switzerland	Icebreaker	Clothing	Textiles
Switzerland	IMINA Technologies	Analysis	Instrumentation
Switzerland	IonBond	Manufacturing	Coatings, Paints, Sealants
Switzerland	JUVENA (International) AG	Personal Care	Cosmetics & Personal Care
Switzerland	Katadyn Products Inc.	Manufacturing	Home, Garden, Environment

Country	Organisation	Category	Sector
Switzerland	La Prairie	Personal Care	Cosmetics & Personal Care
Switzerland	LafargeHolcim Ltd	Construction	Constructions
Switzerland	Logitech	Manufacturing	Instrumentation
Switzerland	Lyncée Tec	Analysis	Instrumentation
Switzerland	Malecular Machines & Industries	Medicine	Instrumentation
Switzerland	Mammut Sports Group AG	Clothing	Textiles
Switzerland	Medskina	Personal Care	Cosmetics & Personal Care
Switzerland	Nano Bridging Molecules	Medicine	Medicine
Switzerland	Nano Pet Products LLC	Pets	Textiles
Switzerland	Nanoscan	Analysis	Instrumentation
Switzerland	NanoSensors	Analysis	Instrumentation

Country	Organisation	Category	Sector
Switzerland	NanoSurf	Analysis	Instrumentation
Switzerland	NanoSys GmbH	Construction	Coatings, Paints, Sealants
Switzerland	NanoWorld	Analysis	Instrumentation
Switzerland	Nestle	Food & Feed	Food & Feed
Switzerland	Novartis Pharmaceuticals Corporation	Medicine	Medicine
Switzerland	novoMOF	Manufacturing	Advanced Materials
Switzerland	Oerlikon	Manufacturing	Coatings, Paints, Sealants
Switzerland	Phasis	Manufacturing	Coatings, Paints, Sealants
Switzerland	Schoeller Textiles AG	Clothing	Textiles
Switzerland	SFC KOENIG AG	Manufacturing	Instrumentation
Switzerland	Solaronix	Manufacturing	Energy

Country	Organisation	Category	Sector
Switzerland	Solaronix SA	Manufacturing	Energy
Switzerland	Solaxess SA	Manufacturing	Energy
Switzerland	STMicroelectronics	Manufacturing	Instrumentation
Switzerland	Sulzer Management Ltd	Manufacturing	Home, Garden, Environment
Switzerland	SuSoS	Manufacturing	Lithography & Printing
Switzerland	Swissdent	Medicine	Medicine
Switzerland	Syngenta	Manufacturing	Home, Garden, Environment
Switzerland	Tecan	Medicine	Medicine
Switzerland	VALERA: Swiss Hair Specialists	Personal Care	Cosmetics & Personal Care
Switzerland	Victorinox Swiss Army	Personal Equipment	Clothing & Personal Equipment

Country	Organisation	Category	Sector
Switzerland	Willy A. Bachofen AG Maschinenfabrik	Manufacturing	Instrumentation
Switzerland	X-Bionic	Clothing	Clothing & Personal Equipment
Switzerland	Zurich Instruments	Analysis	Instrumentation
UK	Advanced Hall Sensors	Manufacturing	Instrumentation
UK	AgActive	Personal Care	Textiles
UK	Agar Scientific	Manufacturing	Instrumentation
UK	AGERA medical formula	Personal Care	Cosmetics & Personal Care
UK	Airflo	Sport & Fitness	Clothing & Personal Equipment
UK	Ancon	Analysis	Instrumentation
UK	ANDIS	Personal Care	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	Andor Technology	Analysis	Instrumentation
UK	Andrew Barton	Personal Care	Clothing & Personal Equipment
UK	Ansmart	Automotive	Aerospace & Automotive
UK	Applied Microengineering	Manufacturing	Instrumentation
UK	Aquila Instruments	Manufacturing	Instrumentation
UK	ATDbio	Medicine	Medicine
UK	Atomic Snow	Home Care	Home, Garden, Environment
UK	Baby Pink or Blue	Home Care	Textiles
UK	Bench	Clothing	Clothing & Personal Equipment
UK	Blistex	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
UK	BOC Edwards	Manufacturing	Instrumentation
UK	Boora	Automotive	Coatings, Paints, Sealants
UK	Breville	Home Care	Instrumentation
UK	Brinkhouse	Home Care	Home, Garden, Environment
UK	Brush-Baby	Medicine	Medicine
UK	Carbolite	Manufacturing	Instrumentation
UK	Carlton	Sport & Fitness	Clothing & Personal Equipment
UK	Charlotte Tilbury	Personal Care	Cosmetics & Personal Care
UK	Colloidal Silver Generators - SciTron	Manufacturing	Home, Garden, Environment
Gibraltar	Cool Chips	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
UK	Corioliss	Personal Care	Clothing & Personal Equipment
UK	Craghoppers	Clothing	Clothing & Personal Equipment
UK	Cranfield University	Home Care	Home, Garden, Environment
UK	Cressington Scientific Instruments	Manufacturing	Coatings, Paints, Sealants
UK	Daffodil	Construction	Constructions
UK	Days Mobility Ltd	Home Care	Textiles
UK	DCN Corp	Manufacturing	Coatings, Paints, Sealants
UK	DermaSox	Clothing	Clothing & Personal Equipment
UK	Discount cleaning supplies	Personal Care	Textiles
UK	Diva	Personal Care	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	Dr Sebagh	Personal Care	Cosmetics & Personal Care
UK	Dulux	Clothing	Clothing & Personal Equipment
UK	Durham Magneto Optics	Analysis	Instrumentation
UK	Duxcoat	Home Care	Coatings, Paints, Sealants
UK	EcoAir	Manufacturing	Instrumentation
UK	Edinburgh Instruments	Analysis	Instrumentation
UK	Element Six	Manufacturing	Instrumentation
UK	Elliot Scientific	Manufacturing	Instrumentation
UK	Endomagnetics	Medicine	Instrumentation
UK	EnviroECOats	Construction	Coatings, Paints, Sealants
UK	Eurochem	Automotive	Coatings, Paints, Sealants

Country	Organisation	Category	Sector
UK	Fischer Instrumentation	Analysis	Instrumentation
UK	G24i	Manufacturing	Energy
UK	Gambridge Display Technology	Manufacturing	Instrumentation
UK	Garnier	Personal Care	Cosmetics & Personal Care
UK	Gearing Scientific	Analysis	Instrumentation
UK	ghd	Personal Care	Cosmetics & Personal Care
UK	Gillette	Personal Care	Cosmetics & Personal Care
UK	Glamoriser	Personal Care	Cosmetics & Personal Care
UK	Glenmuir	Clothing	Clothing & Personal Equipment
UK	GlobalMed Technologies	Personal Care	Cosmetics & Personal Care
UK	Grays International	Sport & Fitness	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	Greenyarn LLC., Indrediwell Limited	Clothing	Clothing & Personal Equipment
UK	Gul	Sport & Fitness	Clothing & Personal Equipment
UK	Hardy	Sport & Fitness	Clothing & Personal Equipment
UK	Heason Technologies Group	Manufacturing	Instrumentation
UK	Heaven Fresh	Manufacturing	Instrumentation
UK	Henniker Scientific	Manufacturing	Coatings, Paints, Sealants
UK	Hiden Analytical	Analysis	Instrumentation
UK	Hiden Isochema	Analysis	Instrumentation
UK	Hilly	Clothing	Clothing & Personal Equipment
UK	Hi-Tec	Clothing	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	Homedics	Home Care	Home, Garden, Environment
UK	Hylamide	Personal Care	Cosmetics & Personal Care
UK	HZO	Manufacturing	Coatings, Paints, Sealants
UK	Infinitesima	Analysis	Instrumentation
UK	Inanovate	Medicine	Medicine
UK	Isogenica	Medicine	Medicine
UK	Jack Pyke	Clothing	Coatings, Paints, Sealants
UK	John Lewis	Clothing	Clothing & Personal Equipment
UK	Johnstones	Construction	Constructions
UK	Joyona International Marketing Ltd.	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
UK	JR Nanotech	Clothing	Clothing & Personal Equipment
UK	Kara	Clothing	Clothing & Personal Equipment
UK	Karakal	Sport & Fitness	Clothing & Personal Equipment
UK	Kinetic	Food & Feed	Food & Feed
UK	KP Technology	Analysis	Instrumentation
UK	Labocon	Analysis	Instrumentation
UK	Lancome	Personal Care	Cosmetics & Personal Care
UK	Lee Stafford	Personal Care	Clothing & Personal Equipment
UK	LEIGHTON DENNY	Personal Care	Cosmetics & Personal Care
UK	Lifestyle Aesthetics Ltd	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
UK	LifeSystems	Medicine	Textiles
UK	Linkam Scientific Instruments	Analysis	Instrumentation
UK	Lipolife	Food & Feed	Food & Feed
UK	Liquiproof	Personal Care	Cosmetics & Personal Care
UK	Lucideon	Manufacturing	Analysis Services
UK	MacBrite	Automotive	Coatings, Paints, Sealants
UK	Magnum	Clothing	Clothing & Personal Equipment
UK	Maine New England FiveG	Clothing	Clothing & Personal Equipment
UK	Mark Hill	Personal Care	Clothing & Personal Equipment
UK	Meaco	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
UK	Micromaterials	Analysis	Instrumentation
UK	Midatech Pharma	Medicine	Medicine
UK	Mi-Net	Manufacturing	Instrumentation
UK	MIR Enterprises	Manufacturing	Lithography & Printing
UK	MOF Technologies	Manufacturing	Advanced Materials
UK	Muc-Off	Sport & Fitness	Clothing & Personal Equipment
UK	Nails. Inc.	Personal Care	Cosmetics & Personal Care
UK	Naneum	Analysis	Instrumentation
UK	Nano-b	Personal Care	Cosmetics & Personal Care
UK	NanoBeam	Manufacturing	Lithography & Printing
UK	Nanogen Products	Personal Care	Cosmetics & Personal Care

Country	Organisation	Category	Sector
UK	NanoMagnetic Instruments	Analysis	Instrumentation
UK	Nanomatrix Materials	Medicine	Medicine
UK	nanoTherics	Medicine	Medicine
UK	Nansulate	Construction	Coatings, Paints, Sealants
UK	Neocell	Food & Feed	Food & Feed
UK	New Guard Coatings Ltd.	Manufacturing	Coatings, Paints, Sealants
UK	Nexeon	Manufacturing	Energy
UK	Nicky Clarke	Personal Care	Clothing & Personal Equipment
UK	Nikalyte	Manufacturing	Coatings, Paints, Sealants
UK	Nikon	Manufacturing	Instrumentation
UK	NinthAvenue	Manufacturing	Instrumentation

Country	Organisation	Category	Sector
UK	No7	Personal Care	Cosmetics & Personal Care
UK	Novacentrix	Manufacturing	Lithography & Printing
UK	NUNano	Analysis	Instrumentation
UK	One Direction	Personal Care	Clothing & Personal Equipment
UK	Optimised energetics	Food & Feed	Food & Feed
UK	Owlstone Nanotech	Manufacturing	Energy
UK	Oxford Advanced Surfaces Group	Manufacturing	Coatings, Paints, Sealants
UK	Oxford Instruments	Manufacturing	Instrumentation
UK	Oxford Nanopore Technologies	Medicine	Instrumentation
UK	Oxsensis	Manufacturing	Home, Garden, Environment
UK	P2i	Manufacturing	Coatings, Paints, Sealants

Country	Organisation	Category	Sector
UK	Panasonic	Personal Care	Instrumentation
UK	Paraytec	Analysis	Instrumentation
UK	Phase Focus	Manufacturing	Instrumentation
UK	Philips	Personal Care	Instrumentation
UK	Pilkington Glass	Manufacturing	Constructions
UK	Piz Buin	Personal Care	Cosmetics & Personal Care
UK	planarTECH	Medicine	Medicine
UK	Plastic Logic	Manufacturing	Instrumentation
UK	Pro Colloidal Silver	Food & Feed	Food & Feed
UK	Prolima Tech, Autobright	Automotive	Coatings, Paints, Sealants
UK	Proskins	Clothing	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	PureLogicol International	Personal Care	Cosmetics & Personal Care
UK	Quorum Technologies	Manufacturing	Instrumentation
UK	RDX. Advance Tech	Medicine	Medicine
UK	Reebok	Clothing	Textiles
UK	Revant Optics	Personal Care	Clothing & Personal Equipment
UK	Richard Ward	Personal Care	Clothing & Personal Equipment
UK	Rodial	Personal Care	Cosmetics & Personal Care
UK	SealSkinz	Sport & Fitness	Textiles
UK	Signo	Home Care	Home, Garden, Environment
UK	Sirakoss	Medicine	Medicine

Country	Organisation	Category	Sector
UK	Smith	Sport & Fitness	Clothing & Personal Equipment
UK	Smith & Nephew	Personal Care	Medicine
UK	Sony	Manufacturing	Instrumentation
UK	Sophie Hulme	Clothing	Textiles
UK	Sphere Fluidics	Medicine	Instrumentation
UK	SPTS Technologies	Manufacturing	Instrumentation
UK	Sunderland of Scotland	Clothing	Clothing & Personal Equipment
UK	Superdry	Clothing	Textiles
UK	Surrey Nanosystems	Manufacturing	Aerospace & Automotive
UK	Syrris	Analysis	Instrumentation
UK	Taylor-Hobson	Analysis	Instrumentation

Country	Organisation	Category	Sector
UK	TeckNet	Manufacturing	Instrumentation
UK	Teer Coatings	Manufacturing	Coatings, Paints, Sealants
UK	Temple Spa	Personal Care	Cosmetics & Personal Care
UK	The Big Brush Company	Personal Care	Clothing & Personal Equipment
UK	The Body Shop	Personal Care	Cosmetics & Personal Care
UK	Tracie Martyn	Personal Care	Cosmetics & Personal Care
UK	Turtle wax	Automotive	Coatings, Paints, Sealants
UK	Turtle Wax Inc.	Automotive	Coatings, Paints, Sealants
UK	Upperton	Medicine	Pharma
UK	Venus professional hair products	Personal Care	Clothing & Personal Equipment

Country	Organisation	Category	Sector
UK	Vidal Sassoon	Personal Care	Clothing & Personal Equipment
UK	Viola	Personal Care	Cosmetics & Personal Care
UK	VITIS	Medicine	Medicine
UK	Vivienne Westwood	Clothing	Clothing & Personal Equipment
UK	WAHL	Personal Care	Cosmetics & Personal Care
UK	Waterpik	Medicine	Medicine
UK	Water-to-Go	Sport & Fitness	Clothing & Personal Equipment
UK	Whitewash	Medicine	Medicine
UK	X1	Automotive	Coatings, Paints, Sealants
UK	Xcel	Sport & Fitness	Textiles

Country	Organisation	Category	Sector
UK	Xline Systems	Home Care	Home, Garden, Environment
UK	Zone 3	Sport & Fitness	Clothing & Personal Equipment

Table A3: Identified NM-related software and services operators in the EU, EEA & Switzerland, and the UK.

Country	Organisation	Sector
Czech Republic	NanoTrade	Trading
Cyprus	NovaMechanics	Data analysis & Predictive Modelling
Finland	Spinverse	Commercialisation
France	Yole Development	Consulting

Germany	M+W Group	Consulting
Germany	Nanocraft	R&D
Germany	Nanogate	R&D and commercialisation
Germany	Nanoanalytics	Analytics
Germany	Tascon	Analytics
Italy	Nanodiagnostics	Consulting
Netherlands	Malsch TechnoValuation	Consulting
Netherlands	Avantium	R&D
Spain	Cognoscible Technologies	Consulting
Switzerland	Innovationsgesellschaft	Consulting

Switzerland	CSEM Swiss Center for Electronics and Microtechnology	R&D
Switzerland	NanoDimension	Venture Capital
Switzerland	Schoeller Technologies	Licensing (textiles)
Switzerland	SGS	Certification
UK	BREC Solutions	Consulting
UK	BlueFrog Scientific	Regulatory Consulting
UK	Cambridge Innovation Consulting (CamIn)	Consulting

UK	Applied Nanodetectors Technology	Licensing and IP
UK	Bio Nano Consulting	Consulting
UK	Efficiency Technologies	Commercialisation
UK	Inex	R&D and commercialisation
UK	Kelvin Nanotechnology	R&D and commercialisation
UK	NanoScope	Analytics

Table A4: Identified NMs in the EU market not listed in EUON, along with their CAS and EC numbers. Where no number is given this was not provided by the manufacturer. (*Mixture)

Substance	EC number	CAS number
(1,2-Methanofullerene C60)-61-carboxyl acid	-	155116-19-1
3-Aminopropyl(3-oxobutanoic acid) functionalized silica* is derived from: N,N-dimethylformamide Quartz	- 200-679-5 238-878-4	- 68-12-2 14808-60-7
4-(1’,5’-Dihydro-1’-methyl-2’H-[5,6]fullereno-C60-Ih-[1,9-c]pyrrol-2’-yl)benzoic acid	-	631918-72-4

Substance	EC number	CAS number
5-Fluoro-2,3-thiophenedicarboxaldehyde	-	1015071-22-3
Aluminium cerium oxide	-	12014-44-7
Aluminum titanium oxide	234-456-9	12004-39-6
Antimony tin oxide is derived from: Diantimony pentoxide Tin oxide	- 215-237-7 242-159-0	- 1314-60-9 18282-10-5
Barium titanate	234-975-0	12047-27-7
Barium ferrite	234-974-5	12047-11-9
Barium strontium titanium oxide is derived from: Barium Strontium Titanium oxide	- 231-149-1 231-133-4 236-675-5	- 7440-39-3 7440-24-6 13463-67-7
Titanium barium oxide	234-975-0	12047-27-7
Boron Carbide	235-111-5	12069-32-8
Boron Nitride	233-136-6	10043-11-5
Boron/Nitrogen co-doped graphene* is derived from: Boron Nitrogen Graphene	- 231-151-2 233-272-6 801-282-5	- 7440-42-8 10102-44-0 1034343-98-0
Boron-doped graphene* is derived from: Graphene Boron	- 801-282-5 231-151-2	- 1034343-98-0 7440-42-8

Substance	EC number	CAS number
Cadmium Selenide	215-148-3	1306-24-7
Cadmium sulfide	215-147-8	1306-23-6
Cadmium telluride	215-149-9	1306-25-8
Calcium Fluoride	232-188-7	7789-75-5
Calcium phosphate, amorphous	232-221-5	7790-76-3
Calcium titanate	234-988-1	12049-50-2
Calcium zirconium oxide	234-586-6	12013-47-7
Carbon fibres	-	308063-56-1
Carbon nanofibers, polyacrylonitrile-based	-	308063-67-4
Cd-based Core/Shell Quantum Dots with Streptavidin* is derived from: Maleic anhydrate-methyl vinyl ether copolymer Octadecylamine Cadmium selenide	- 618-469-0 204-695-3 215-148-3	- 9011-16-9 124-30-1 1306-24-7
CdSeS/ZnS alloyed quantum dots* is derived from: Toluene Cadmium Selenide	- 203-625-9 215-148-3	- 108-88-3 1306-24-7
Cerium Iron Oxide	-	59656-34-7
Cerium iron oxide hydroxide	-	-
Cerium Zirconium Oxide	258-407-6	53169-24-7

Substance	EC number	CAS number
Cobalt	919-713-1	7440-48-4
Cobalt iron oxide	234-992-3	12052-28-7
Copper iron oxide	-	12018-79-0
Copper Zinc alloy*	-	63338-02-3
Copper oxide	215-269-1	1317-38-0
Diamond	231-953-2	7782-40-3
Dodeca(2,3,4,5,6-pentafluorobenzyloxy)- hypercloso-dodecaborane	-	-
Dodecanethiol functionalized gold nanoparticles* is derived from: Gold Toluene Dodecane-1-thiol	- 231-165-9 203-625-9 203-984-1	- 7440-57-5 108-88-3 112-55-0
Didysprosium trioxide	215-164-0	1308-87-8
Dierbium trioxide	235-045-7	12061-16-4
Europium(III) oxide	215-165-6	1308-96-9
Fullerene-C76	-	142136-39-8
Digadolinium trioxide	235-060-9	12064-62-9
Germanium hydride	-	13572-99-1
Gold	231-165-9	7440-57-5

Substance	EC number	CAS number
Graphene ink*	203-631-1	108-94-1
Holmium(III) oxide	-	12055-62-8
C60 derivative, indene-C60 bisadduct, 1',1'',4',4''-Tetrahydro-di[1,4]methanonaphthaleno[1,2:2',3',56,60:2'',3''][5,6]fullerene-C60	694-477-8	1207461-57-1
Indium oxide	215-193-9	1312-43-2
Indium Phosphide Zinc Sulfide Quantum Dots* is derived from: Indium Phosphide Zinc Sulfide	- 244-959-5 215-251-3	- 22398-80-7 1314-98-3
Indium tin oxide	-	50926-11-9
Iron nickel oxide	235-335-3	12168-54-6
Iron-doped (5 at%) hydroxyapatite nanopowder* is derived from: Iron Hydroxyapatite	- 231-096-4 235-330-6	- 7439-89-6 12167-74-7
Lanthanum nickelate	-	12031-41-3
Lanthanum oxide	215-200-5	1312-81-8
Styrene:Maleic Anhydride Copolymer 3:1*	-	-
Lutetium	231-103-0	7439-94-3
Magnesium aluminate	235-100-5	12068-51-8
Magnesium oxide	215-171-9	1309-48-4

Substance	EC number	CAS number
Manganese oxide	215-202-6	1313-13-9
Molybdenum disulfide	215-263-9	1317-33-5
Molybdenum oxide	215-204-7	1313-27-5
Neodynium oxide	215-214-1	1313-97-9
Nickel cobalt oxide	261-346-8	58591-45-0
Nickel zinc iron oxide	-	12645-50-0
Cobalt	231-158-0	7440-48-4
PtCo/graphene nanocomposite* is derived from: Platinum Cobalt Graphene	- 231-116-1 231-158-0 801-282-5	- 7440-06-4 7440-48-4 1034343-98-0
Quaterrylene	-	188-73-8
Rhodium	231-125-0	7440-16-6
Ruthenium	231-127-1	7440-18-8
Samarium(III) oxide	235-043-6	12060-58-1
Selenium nanoparticles	231-957-4	7782-49-2
Sepiolite	264-465-3	63800-37-3
Silicon dioxide	262-373-8	60676-86-0

Substance	EC number	CAS number
Silicon nitride	234-796-8	12033-89-5
Silver-tin alloy* is derived from: Tin Silver	- 231-141-8 231-131-3	- 7440-31-5 7440-22-4
Sulfur-doped graphene* is derived from: Sulfur Graphene	- 231-722-6 801-282-5	- 7704-34-9 1034343-98-0
Tantalum	231-135-5	7440-25-7
Tetraterbium heptaoxide	234-856-3	12037-01-3
Tin	231-141-8	7440-31-5
Titanium	231-142-3	7440-32-6
Titanium aluminium carbide 211*	603-064-3	12537-81-4
Titanium aluminium carbide 312*	-	196506-01-1
Titanium	231-142-3	7440-32-6
Titanium silicon oxide* is derived from: Titanium Silicon oxide	- 231-142-3 231-545-4	- 7440-32-6 7631-86-9
Titanium dioxide, anatase	215-280-1	1317-70-0
Titanium dioxide, brookite	-	12188-41-9

Substance	EC number	CAS number
Tricalcium phosphate hydrate	231-840-8	7758-87-4
Tungsten carbide	235-123-0	12070-12-1
Pentaaluminium triyttrium dodecaoxide	12005-21-9	12005-21-9
Yttrium iron oxide*	-	12063-56-8
Zinc iron oxide*	-	12063-19-3
Zinc titanium oxide	-	12036-43-0

EU, EEA & Switzerland NMs market survey

Proposed questionnaire for the "Market study of the EU market on nanomaterials, including substances, uses, volumes and key operators"

Dear Participant,
We are conducting a market research on the nanomaterials (NMs) available on the European Union (EU) market on behalf of the EU Observatory for Nanomaterials (EUON) and the European Chemicals Agency (ECHA). You can see attached the letter of endorsement from EUON/ECHA.
As part of the study, we are required to identify the substances available as NMs on the EU market and perform market projections for the EU NMs market. To facilitate this, we are sharing this questionnaire, which should not take more than 15 minutes to complete, to help us gather the necessary information.
As a stakeholder involved in NMs production, distribution or formulation, we would appreciate your participation in this study. Following participation, if you wish, you can gain early access to the report that we will compile with EUON/ECHA. In any case, any information shared with us will be treated, if desired, as confidential and while they will be used during analysis they will not be published.
If you don't wish to fill in the questionnaire and would prefer to participate via a live (online) interview, we would be happy to arrange this with you. Please mail us at echa@novamechanics.com.
Thank you very much in advance for your time and participation.
Best Regards,

Section 1 Personal information

- Name:
- Company:
- Position:
- Email:
- Phone number:

Section 2 Commercial information (Sub-questions a-c will appear only if the user clicks Yes in the main question)

1. Is your company producing substances that are available on the EU market as nanomaterials or which contain nanomaterials? Yes/No
    a. You answered Yes in question 1. Is the combined bulk and nanomaterial volume produced above 1 ton per year?
    b. You answered Yes in question 1a. Can you please tell us which are these substances? Please include a relevant identifier, e.g., IUPAC name, CAS or EC number.
    c. You answered Yes in question 1, but produce less than a combined bulk and nanomaterial volume of 1 ton per year. Can you please tell us what substances you are producing or provide a link to an online catalogue?
2. Is your company importing substances that are available as nanomaterials in the EU market?
    a. You answered Yes in question 2. Is the combined bulk and nanomaterial volume imported above 1 ton per year?

   b. You answered Yes in question 2a. Can you please tell us which are these substances? Please include a relevant identifier, e.g., IUPAC name, CAS or EC number.
   c. You answered Yes in question 2, but import less than a combined bulk and nanomaterial volume of 1 ton per year. Can you please tell us which substances you are importing or provide a link to an online catalogue?
3. Is your company a downstream user of substances that are available on the EU market as nanomaterials or which contain nanomaterials?
   a. You answered Yes in question 3. Is the combined bulk and nanomaterial volume used above 1 ton per year?
   b. You answered Yes in question 3a. Can you please tell us which are these substances? Please include a relevant identifier, e.g., IUPAC name, CAS or EC number.
   c. You answered Yes in question 3, but use less than a combined bulk and nanomaterial volume of 1 ton per year. Can you please tell us which substances you are importing or provide a link to an online catalogue?
4. Should any provided information be treated as confidential? Yes/No
   a. If yes, please indicate which (e.g., answer to question 2b etc).

Section 3 Regulatory information

5. Have you registered your substances with ECHA via REACH?
   a. You have answered Yes in question 5. Please indicate which substances have been registered as nanoforms.
   b. If not, are you in the process of registering your materials/products?
6. Should any provided information be treated as confidential? Yes/No
   a. If yes, please indicate which.

Section 4 Distribution and market information

7. Which upstream and/or downstream users do you collaborate with?
8. Can you describe your distribution chain?
9. Who are your main competitors with respect to nanomaterials?
10. Should any information provided in this section be treated as confidential?
    a. If yes, please tell us which (i.e., answer to question 8 etc).

Section 5 Market projection

11. How do you think the nanomaterials market will look in the next 5 years? (Bigger/Smaller/The same)
12. If not the same, can you give us an estimate of the change?
13. Do you think there will be more, less or the same number of nanomaterials-containing products? (more than 25% more, more than 10% more, more than 5%, the same, less than 5%, less than 10%, less than 25%, other)
14. Do you foresee the emergence of new nanomaterials as substances and/or nanomaterials-containing products on the market?
    a. If yes, which?
15. What do you think is the public perception regarding nanomaterials and nanomaterials -containing products?
16. What are the barriers regarding the expansion of the nanomaterials market?
17. How do you think the current regulatory framework affects/will affect the EU nanomaterials market?
18. Should any information provided in this section be treated as confidential?

   a. If yes, please tell us which.
19. Would you be interested to participate in a focus group regarding the future of the nanomaterials market? Yes/No
   a. If yes, can we contact you to discuss further?
20. Would you be interested to give us a personal perspective regarding the future of the nanomaterials market? Yes/No
   a. If yes, can we contact you to discuss further?

EU, EEA & Switzerland NMs market focus groups and interviews questionnaire

Thank you for agreeing to participate in the Focus Groups process and helping us "test-drive" the questions to be asked. Below you will find these questions, which will be asked in 3 sections. We would like to ask for both your opinion on the questions to be asked and for your answers to the specific questions.

Any answers you provide will not be directly shared with anyone or it will be able possible for anyone to identify any of the answers that you provided. Instead, during the focus groups, an anonymised summary of the answers received from different experts will be provided and comments will be asked from all participants, including if this summary changes any of the viewpoints expressed (i.e, via a second round of answering).

Thank you in advance for your time and your help.

Section 1	
What is the current state of the EU nanomaterials market?	
What was the impact of the COVID-19 pandemic?	
Section 2	
What do you think will be the future of the EU nanomaterials market in the next 5 years in term of:	
Materials?	
Volumes?	
Growth?	
Which do you think will be the main drivers/barriers (types of nanomaterials, regulation, EU and global trade, R&D, specialised needs etc.)?	
How do you see global nanomaterials trade affecting the EU market?	
Do you foresee new nanomaterials emerging and driving the market, or nanomaterials exiting/lagging?	
Who are the major producers/traders/downstream users in the market?	

Section 3	
Is there anything else you would like to say regarding the EU nanomaterials market?	