Inventory of available tools, methods, approaches and best practices.

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EC4SafeNano Project

The European Centre for Risk Management and Safe Innovation in Nanomaterials and Nanotechnologies, EC4SafeNano, is a 2016-2019 Coordination and Support Action, funded by the European Commission. EC4SafeNano is coordinated by INERIS, and operated together by major European human health and environmental risk institutes with the support of numerous associated partners, gathering all stakeholders involved in Nanomaterials and Nanotechnologies (regulators, industry, society, research, service providers...).

A central challenge to ensure the sustainable production and use of nanotechnologies is to understand and effectively control the risks along the industrial innovation value chain. Knowledge about nanotechnology processes and nanosafety issues (hazards, fate, risk...) is growing rapidly but the effective use of this knowledge for risk management by market actors is lagging behind.

EC4SafeNano will promote a harmonized vision of expertise in risk assessment and management for the public and private sectors to enable the safe development and commercialization of nanotechnology. The main objective of EC4SafeNano is to design harmonized services in risk assessment and management and a sustainable structure to deliver these services. For that, the project will gather stakeholder needs and expertise resources. It will demonstrate the efficiency of the proposed solution on case studies.

Executive Summary

Many resources which aim to improve human and environmental nanosafety have been developed by research organizations and EU funded projects. These resources include tools and methods, trainings, standards, standard operating procedures (SOPs), guidance documents and best practices. In the present deliverable, an overview of these resources is provided which could published on the EC4SafeNano platform in an adjusted form. The inventory is not exhaustive, but will give a useful overview.

In order to make the inventory of resources operational, descriptive parameters and quality criteria referring to, e.g. validation and applicability domain, were defined and the resources are described as reported by the tool developers by these parameters and criteria. These parameters and criteria can be used by users to select the resources that they need and make distinctions between resources of the same kind based on quality criteria. Within their overview, the resources are not ranked/judged based on the parameters and criteria.

Until M24, a total of 28 tools and methods, 5 trainings, 77 standards, 136 SOPs and 43 Guidance and Best practice documents, presenting recommendations related to various nanosafety issues, were included in the overview. Post M24, efforts to update the resources overview were continued to build up their comprehensive library and are now included in the present M36 version of this deliverable. These updates mainly correspond to including updated information on the tools, more resources in the overview and make it in line with its direct use in the Fit & Gap Analysis (FGA) tool as part of WP3 and the final survey as part of WP5.

It is foreseen to further continue elaborating the library on the basis of new information or resources that has become available during the course of EC4SafeNano project. For this, together with WP3 and WP4, relevant user guidelines have been developed in this M36 version in the form of a multi-module user manual which consists of steps to assist a user while registering new resource and updating an existing resource in the library in the future.

As per the new updates (M36), there are now 31 tools and methods (3 new as compared to M24), 13 trainings (8 new as compared to M24), 77 standards (same as M24), 136 SOPs (same as M24) and 52 Guidance and Best practice documents (9 new as compared to M24) in the library. To make the library in line with its use in the FGA tool, each resource is classified as per 12 service chapters and 27 service categories of FGA tool. This would assist FGA tool user to select the appropriate chapter(s) and service category(ies) for each resource to make a fair assessment of fit and gap for these resources.

The inventory is also used to organize and facilitate the registration of new resources for service provision. The registry tool (see D5.3) uses a VBA macro to create dynamic lists of the inventory items according to the 12 service categories and 27 service topics used in the FGA tool. The registry worksheet is then using these lists of tools, methods, trainings, standards, SOPs, Guidance and Best practice documents.

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List of Acronyms

Acronym	Definition
ASTM	American Society for Testing and Materials
CEN	Comité Européen de Normalisation (European Committee for Standardization)
DIN	Deutsches Institut für Normung (German Institute for Standardization)
ECTS	European Credit Transfer System
FGA	Fit&Gap Analysis
ISO	International Organization for Standardization
OECD	Organization for Economic Co-operation and Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals, Regulation (EC) No 1907/2006
SOP	Standard Operating Procedure

1 Introduction

Over the past two decades, many resources have been developed by research organizations and EU funded projects to improve human and environmental nanosafety. In WP2 an inventory of such available resources is compiled. This deliverable D2.3 describes the outcomes of Task 2.2 i.e. inventory of nanosafety related tools and methods, trainings, standards, standard operating procedures (SOPs), guidance documents and best practices.

An overview of these available resources is provided in a MS Excel template that can be used to aid safe innovation in the field of nanotechnologies. The inventory is not exhaustive, but aims to give a useful overview.

In order to make the inventory of resources operational, first descriptive parameters and quality criteria referring to, e.g. validation and applicability domain, were defined. Subsequently all resources were described as reported by the tool developers by these parameters and criteria. The library comprising these resources will become available on the EC4SafeNano platform. The parameters and criteria can be used by the users to select the most appropriate resource that is needed for the purpose of the user. At the end of the project, the library was updated based on new information or resources that had become available during the EC4SafeNano project.

2 Methods

2.1 Defining the descriptive parameters and quality criteria

Different types of resources are available which can largely be described by the same descriptive parameters and quality criteria. However, some descriptive parameters and quality criteria are not relevant for all the types of resources. Therefore, first the different types of resources were defined and subsequently the descriptive parameters and quality criteria for these resources.

2.1.1 Definition of the different types of resources

Different types of tools are available. Below you find the definition of the types of tools as used in this report.

Type of tools	Definition
Tools and methods	A tool is an instrument (e.g. model) to obtain a specific result (e.g. software model, computation on paper) and a method is a description of how to do the work (e.g. risk assessment frameworks)
Trainings	Reoccurring organized activity aimed at imparting information and/or instructions to improve the recipient's performance or to help him or her attain a required level of knowledge or skill. The training tools include neither university study programs nor one-time events.
Standards or test guidelines	Standards or test guidelines are documents approved by an international or national standards setting organization (e.g. ISO, CEN, OECD, DIN, ASTM) that set out specifications and other technical information with regard to various kinds of products, materials, services and processes.
SOPs	A standard operating procedure (SOP) is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations.
Guidance or best practices	A guidance or best practice document gives a recommendation on how to perform specific activities.

2.1.2 Definition of descriptive parameters and quality criteria

For each type of resources, descriptive parameters and quality criteria were described in MS Excel worksheets. This was needed as not all descriptive parameters and quality criteria are relevant for all types of resources. For instance, the validation of standards is performed by a specific review process, which is quite different from the validation of an online tool like Stoffenmanager based on a measurement data.

The process of defining the descriptive parameters and quality criteria contained different steps:

Step 1. Based on the information that is requested in Task 3.2 “Defining the global offer: the didactic catalogue of services” of WP3, a first set of descriptive parameters and quality criteria was defined in MS Excel.

Step 2. The list defined in step 1 is further extended with parameters and criteria based on expert knowledge.

Step 3. The list of descriptive parameters and quality criteria, defined in step 2, was reviewed and adjusted by the task partners based on their knowledge regarding the type of tools, in a teleconference and by e-mail.

Step 4. After the inclusion of a limited number of examples for the different categories, the descriptive parameters, quality criteria and drop menus were discussed again in a teleconference and adjusted. Subsequently the MS Excel input worksheets were finalized.

In the following sections, the descriptive parameters and quality criteria are presented for each type of tool.

2.1.2.1 Tools and methods

Table 1: Descriptive parameters and quality criteria for tools and methods.

Descriptive parameter & quality criteria	Description
General descriptors	
Name	The name of the tool by which it is called by the developer or mentioned in its user manual.
What does the tool do?	Objective of the tool
What is the output?	What does the tool give you?
Developer	The name of the researcher/ laboratory/ institute/ consortium/ project who/which developed the tool.
Type of tool	In what format is the model implemented? Is there a programming language used, or a program that is required to run the model?
Link to tool or method	The internet or reference link to access the tool.
Proposed user	For which type of user is the tool developed?
Guidance available?	Is guidance available to use the tool?
Applicability domain - Nanospecific tool or method	For what and where can the tool be used?
Applicability domain - type of nanomaterial	For what type of nanomaterial can the tool be used?
Applicability domain - state of the particle	If not clear from tool then include unknown.
Applicability domain - Specific activities excluded	Give a description of the activity/activities for which the tool is specifically not developed or applicable
Applicability domain - Specific activities included	Give a description of the activity/activities for which the tool is specifically developed
Industrial sector	Is the tool developed for a specific industry?
Industrial sector	Please specify the industrial sector
Language	In which language can the tool be used?
Availability	Does the user need to pay to avail of the tool?
Technical description	
Tiered approach	Does the tool or method describe or follow a tiered approach?
Modular approach	Is the information provided to the tool divided into separate parts/modules?

If yes, can modules of the tool be used individually?	-
Precautionary consideration	How does the tool deal with data gaps? Does the tool stop? Or Worst case estimated? Or Does the tool ask for ranges or approximate value?
Iteration/adaptation possibilities	Is it possible to add/modify data as it becomes available, or in a next stage? Is it possible to use Bayesian statistics
Quality assessment of the tool	
Has the tool been validated?	Indicate the level of calibration and or validation
If validated, external or internal?	-
Is the tool published in peer reviewed article?	-
Is the tool developed in line with standard?	-
If yes, specify the name of the standard	e.g. CEN, ISO, OECD etc.
Is the tool transparent?	Are all calculations/computations/algorithms fully accessible to the user? Are default values explained?
Is the tool accepted for REACH?	Is the tool identified within the REACH guidance documents?
Market readiness	What level of market readiness does the tool have?

2.1.2.2 Trainings

Table 2: Descriptive parameters and quality criteria for trainings.

Parameter & quality criterion	Description
General descriptors	
Name	The name of the training by which it is called by the provider.
Content	Training contents as advertised by the provider.
What is the outcome?	Learning outcomes, which sums up knowledge and skills that participants have gained after the training.
Provider	The name of the institution/ laboratory/ consortium/ project who/which provides the training.
Format	In what format is the training implemented?
Location	Where does the training take place?
Link to tool or method	The internet or reference link to access the tool.
Permanence	Is this an on-going offer that can be planned with for the foreseeable future?
Frequency	How often is the training offered?
Time requirement	How much time needs to be budgeted for successfully participating to the complete training?
Proposed user	For which type of user is the training developed?
Availability	What are the known starting dates?
Cost	What are the maximal costs for participation of one person, excluding (where applicable) travel costs? Cost in Euros
Certificates	Are official certificates awarded? If yes, which ones?

ECTS (European Credit Transfer System)	Are ECTS awarded?
On the job	Is this training designed to allow training of people who are in the workforce?
Industrial sector	Is the tool developed for a specific industry?
Industrial sector	Please specify the industrial sector
Language	In which language is the training provided?
General descriptors	
Curriculum	Is the training part of a larger curriculum intended for sequential training?
Modular approach	Is the training structured into modules?
If yes, can modules be used individually?	-
Training units	For practical courses: Will they be performed as one coherent course, or as more than one temporally separate course units?
Input by participants	Can participants bring their own materials or specific questions, which will be included in the training?
Quality assessment of the training	
Has the tool been evaluated by experts?	Indicate the results
Has the tool been evaluated by participants?	Indicate the results
Has the tool been evaluated by employers?	Indicate the results
Were users involved in setting up the training?	
Are employers involved in providing the training?	
Are data available that give comparisons to other trainings?	

2.1.2.3 Standards or test guidelines

Table 3: Descriptive parameters and quality criteria for standards.

Parameter & quality criterion	Description
General descriptors	
Title	The name of the standard or test guideline by which it is called by the authors
Code of the standard or test guideline	For example the ISO, OECD or CEN reference
What does the standard or test guideline do?	Objective of the standard of test guideline
What is the output?	What does the document give you?
Standardization body	For example ISO, CEN
Link to standard or test guideline	The internet or reference link to access the tool.
Proposed user	For which type of user is the standard or test guideline developed?
Industrial sector	Is the standard or test guideline developed for a specific industry?
Industrial sector	Please specify the industrial sector

Language	In which language can the standard or test guideline be used?
Status of the standard or test guideline	Is the standard or test guideline published? Or in review status?
Status of the standard or test guideline	If not published yet, when will the standard or test guideline become available?
Quality assessment of the standard or test guideline	
If available give link to background information regarding the standard or test guideline published	e.g. Report or published paper
Is the standard or test guideline accepted for REACH?	Is the Standard or test guideline identified within the REACH guidance documents?

2.1.2.4 SOPs

Table 4: Descriptive parameters and quality criteria for SOPs.

Parameter & quality criterion	**Description**
General descriptors	
Name	The name of the SOP by which it is called by the authors
What does the SOP do?	Objective of the SOP
What is the output?	What does the document give you?
Developer	The name of the researcher/ laboratory/ institute/ consortium/ project who/which developed the SOP.
Type of SOP	In what format is the SOP provided?
Link to SOP	The internet or reference link to access the tool.
Proposed user	For which type of user is the tool developed?
Industrial sector	Is the tool developed for a specific industry?
Industrial sector	Please specify the industrial sector
Language	In which language can the tool be used?
Availability	Does the user need to pay to avail of the SOP?
Quality assessment of the SOP	
Has the SOP been validated?	Indicate the level of calibration and or validation
If validated, external or internal?	-
Is the SOP published in peer reviewed article?	-
Is the SOP developed in line with standard?	-
If yes, specify the name of the standard	e.g. CEN, ISO, OECD etc.
Is the SOP transparent?	Are all steps fully accessible to the user? Are default values explained?

2.1.2.5 Guidance and Best practices

Table 5: Descriptive parameters and quality criteria for guidance and best practices.

Parameter & quality criterion	**Description**

General descriptors	
Name	The name of the guidance or best practice by which it is called by the developer.
What does the guidance or best practice approach focus on?	Objective of the guidance or best practice
Developer	The name of the researcher/ laboratory/ institute/ consortium/ project who/which developed the approach.
Format of the guidance or best practice approach	In what format is the approach presented?
Link to description of the approach	The internet or reference link to the description of the approach.
Proposed user	For which type of user is the approach developed?
Applicability domain - Nanospecific guidance or best practice approach	Is the guidance or best practice nanospecific?
Applicability domain - type of nanomaterial	For what type of nanomaterial can the approach be used?
Applicability domain - Specific activities included	Give a description of the activity/activities for which the approach is specifically developed
Applicability domain - Specific activities excluded	Give a description of the activity/activities for which the approach is specifically not developed or applicable
Industrial sector	Is the approach developed for a specific industry?
Industrial sector	Please specify the industrial sector
Language	In which language is the approach presented?
Availability	Does the user need to pay to get access to the guidance or best practice?
Quality assessment of the guidance or best practice	
Is the guidance or best practice approach published in peer reviewed article?	-

2.1.3 Inclusion of resources

For each type of resource, the following strategy was followed to collect the resources:

Step 1: Within the task, partners with specific knowledge regarding the type of resources were involved. These partners were asked to take the lead in making the overview of resources for their expertise and to coordinate the inclusion of resources in the MS Excel input files.

Step 2: The partners who were involved in the development of specific resources or are/were involved in EU projects/programs in which resources were included/reviewed or have experience of using these resources were asked to include their inputs. For example, the tools and methods resources were obtained from the EU H2020 caLIBRAte project through NRCWE who is in EC4SafeNano and also the coordinator of caLIBRAte.

Step 3: A literature search and search on the internet was performed to find additional tools. Search terms like 'nanosafety', 'best practice', 'guidance', 'recommendation', 'handling nano', 'nano', 'tool' and 'risk' were used.

2.1.4 Defining the service chapters and categories

The inventory is also used to organize and facilitate the registration of new resources for service provision. The registry tool (see D5.3) uses a VBA macro to create dynamic lists of the inventory items according to the 12 service categories and 27 service topics employed by the Fit & Gap Analysis (FGA) tool of WP3. The

registry worksheet is then using these lists of tools, methods, trainings, standards, SOPs, Guidance and Best practice documents.

In order to create these lists, each one of the resources in the inventory was classified as per service chapter(s) and service category(ies) to which they are applicable. The service chapters and categories are two of the four input factors which need to be configured in the FGA tool for the definition of a customized scenario for analysis by the FGA tool. In total, 12 such service chapters and 27 service categories have been identified Table 6:

Table 6: List of service chapters and categories

Code	Service chapters	Code	Service categories
1	We carry out testing & measuring	1	Concentrations and characteristics (physical/chemical properties like size, shape, solubility, surface chemistry, dustiness,etc)
2	We perform certification for testing	2	Emissions (to air, water, waste stream)
3	We perform certification for products	3	Fate (bioavailability, bioaccumulation, degradation, leaching, environmental distribution)
4	We conduct consultancy	4	Hazard/toxicokinetics assessment - Physical hazards (incl. group. & read-across)
5	We conduct training	5	Hazard/toxicokinetics assessment - Health effect (incl. group. & read-across)
6	We contribute in protocols development	6	Hazard/toxicokinetics assessment - Ecosystem effects (incl. group. & read-across)
7	We specify reference values	7	Exposure assessment - Workers
8	We contribute in guidelines development	8	Exposure assessment - Consumers/General public
9	We contribute in models development	9	Exposure assessment - Environmental organisms
10	We contribute in software development	10	Risk assessment - Workers
11	We contribute in shared databases	11	Risk assessment - Consumers/General public
12	We contribute in standards development	12	Risk assessment - Ecosystem
		13	Risk management - Workers
		14	Risk management - Consumers/General public
		15	Risk management - Ecosystem
		16	Risk prevention (incl. Safety-by-design)
		17	Risk perception and societal acceptance

		18	Prioritizing/weighing risks and benefits
		19	Efficacy of Personal Protection Equipment (PPEs)
		20	Waste management
		21	Life cycle assessment (LCA)
		22	Circularity nano-containing products (Circul. Econ.)
		23	Registration dossiers (REACH, Biocides, Cosmetics)
		24	Compliance with regulation
		25	Risk Assessment - process
		26	Risk Management - process
		27	Cost, benefit analysis

3 Results

3.1 Inventory of available resources

The MS Excel file belonging to this report gives the inventory of the resources available that can be used in the view of nanosafety. For each type of resources some general information is given in the following paragraphs.

3.1.1 Tools and methods

Until M24, 28 available tools and methods were included into the inventory which was updated to 31 tools and methods in M36. These tools address risk assessment of nanomaterials for both humans (30 tools) and the environment (8 tools). As shown in Figure 1, presented tools and methods are either for risk modeling (service chapter #9) which includes Tier 1 models (assessment may rely on general exposure indicators and scenarios by scaling of release and/or exposure potentials based on product and exposure characteristics), with a couple of Tier 2 and 3 models (more advanced exposure models can be used, with quantitative exposure levels, scenario-specific statistical data or expert opinions) or are software tools (service chapter #10). On the other hand, the tools and methods in the inventory are distributed almost over whole spectrum of service categories from #1 to #15 and #21. The inventory still lacks the tools and methods which correspond to the rest of the service categories (#16-20, #22-27), it might be however that, certain combinations of service chapter/category may be very unlikely. Most of the tools and methods are free to run, transparent, nano-specific, handle data gaps, are at least market-ready and are not specific to industry. Most of the tools/methods recommend that the potential users are employees with expertise in the use of the tools.

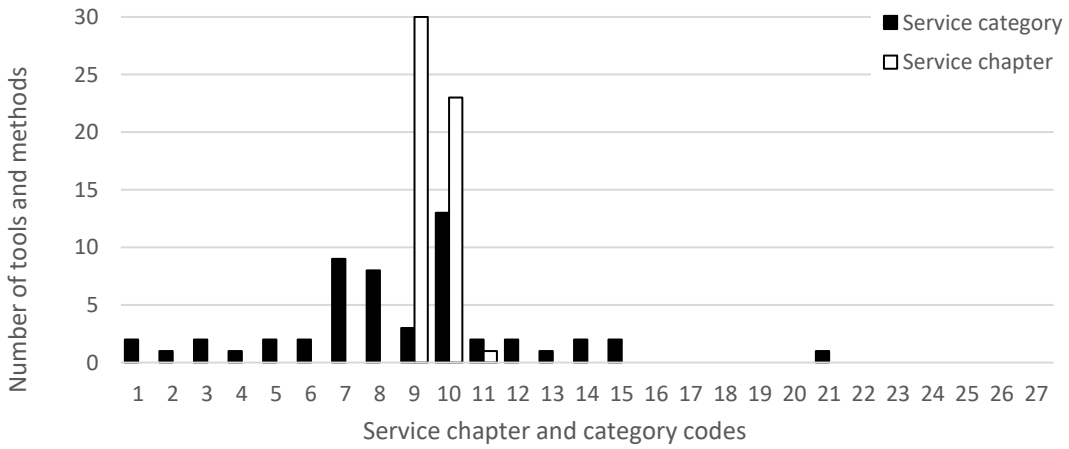

Figure 1: Number of tools and methods in the resources inventory classified as per 27 service categories and 12 service chapters (see Table 6 for service category and chapter codes)

3.1.2 Trainings

Compared to M24, 8 new training courses are now included in the inventory, making it a total of 13 training courses in M36 which fall under service categories from #4 to #17 and #19 (Figure 2). The inventory does not take into account trainings that

1) Take place outside of Europe
2) Are study programs (bachelor, master, doctoral) at universities
3) Are offered only once

The training inventory aims at providing knowledge about trainings that are repeatedly offered or are permanently available as on-line courses. Offers of this type allow longer term planning and policy implementation. For example, it would be useful to send all new employees routinely to a training event about nanosafety. In this way, the workforce - at any specific skill level - would have a solid background on this issue and except for necessary updates to course contents, the same standard could be applied to all employees.

The number of offers addressing this need is low. Study programs are often too long (two years for a master) and too extensive to consider for training on the job. One-time events, often associated with meetings or projects, can provide excellent training, but do not cater for a sustainable training program. EC4SafeNano will analyze this situation and address both the specific training needs and the approaches necessary to meet them in a sustainable way with high quality training offers.

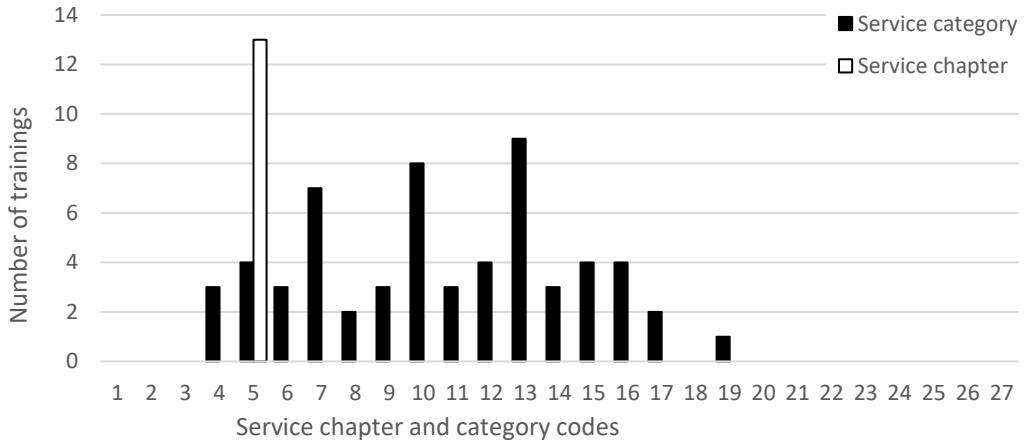

Figure 2: Number of trainings in the resources inventory classified as per 27 service categories and 12 service chapters (see Table 6 for service category and chapter codes)

3.1.3 Standards or test guidelines

No new standards or test guidelines have been added to the overview of standards in M36 and their total number is same as M24 i.e. 46 standards and 31 guidelines. However, some descriptive information is updated, e.g. new links to the tools were added. These standards and guidelines correspond to numerous service categories, most of them are for characterization services (Figure 3). Standards are available from ISO, ISO DIN, EN, IEC, CEN, ASTM and OECD. In addition, a number of standards under development were identified. Proposed users for most of the standards are experts or employees with expertise to use standards. The standards are for general use and not specific for an industrial sector. Other standard or guidelines give lists of terms and definitions or guidelines how to perform specific tests, measurements or risk-, hazard- or exposure assessment.

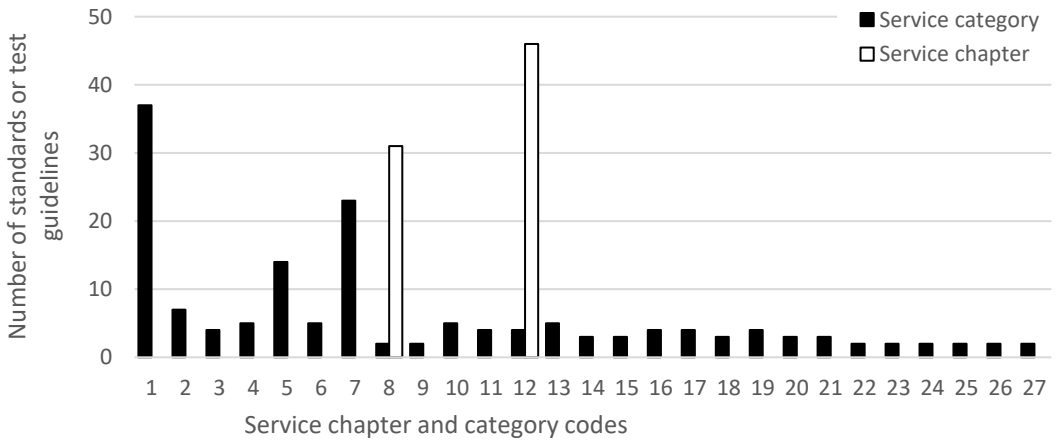

Figure 3: Number of standards and test guidelines in the resources inventory classified as per 27 service categories and 12 service chapters (see Table 6 for service category and chapter codes)

3.1.4 SOPs

136 standard operating procedures (SOPs) are included into the inventory, same for both M24 and M36. The SOPs are well documented, transparent, open-access and come from the NANoREG project deliverables[1] and DaNa database[2]. The SOPs were developed in the different service categories of synthesis, supplying and characterization, exposure through life cycle analysis, biokinetics and toxicity testing in vivo, and advancement of regulatory risk assessment and testing on nanomaterials (Figure 4). Proposed user for most of the tools/methods are well educated employees.

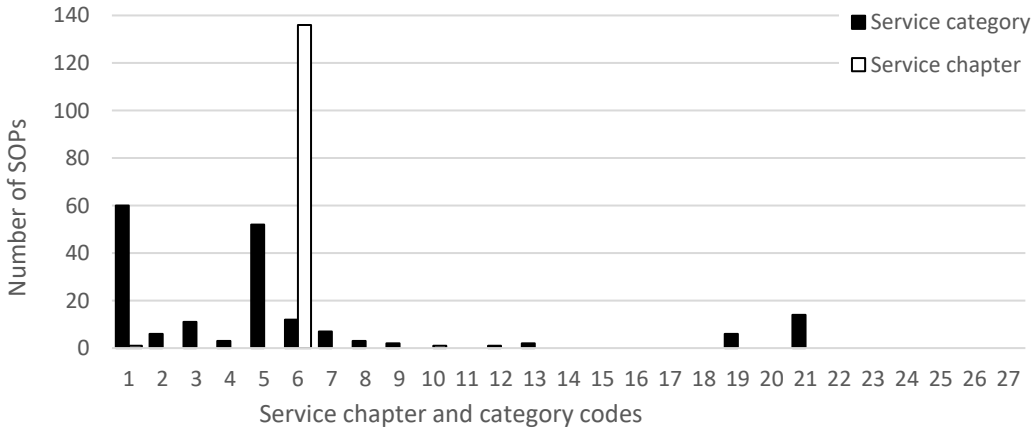

Figure 4: Number of SOPs in the resources inventory classified as per 27 service categories and 12 service chapters (see Table 6 for service category and chapter codes)

3.1.5 Guidance and Best practices

There are now 52 Guidance and Best practices related documents in M36, showing an increase of 9 in the number compared to M24. These guidances and best practices present recommendations related to various nanosafety issues which are distributed all over the service category spectrum (Figure 5). In particular, there are seven best practices considering the handling of nanomaterials, and one of these is also on Human exposure assessment. All the other documents are guidance manuals on nanosafety issues, including exposure assessment, risk assessment, handling nanomaterials at workplaces (including laboratories), risk management recommendations and environmental assessment. The main developers are European organization (European Chemicals Agency ECHA, and the European Commission), international or national organizations (e.g., Organization for Economic Co-operation and Development (OECD), National Institute of Occupational Safety and Health (NIOSH), Swiss National Accident Insurance Found, Occupational Safety and Health Administration (OSHA), Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA) , and Safe work

Australia), and European projects (Scaffold, NanoSafePack NanoValid and NanoReg). All the collected documents are web-based and freely available.

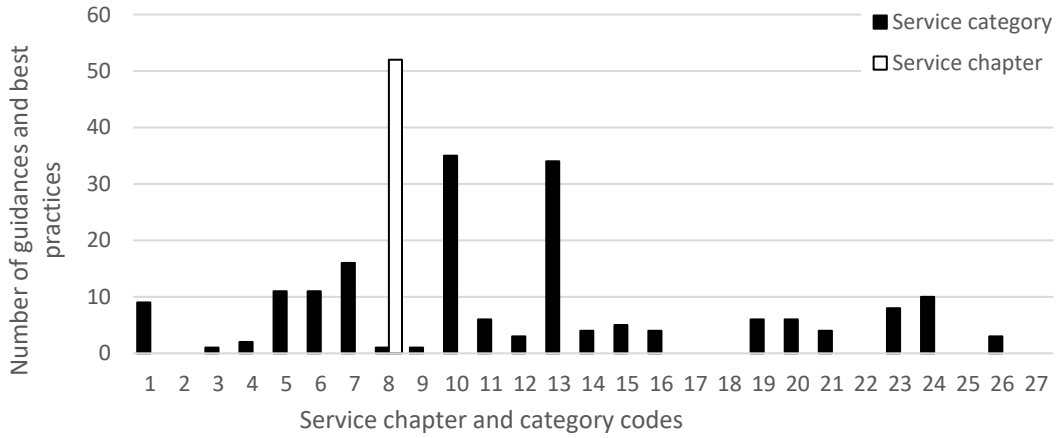

Figure 5: Number of guidances and best practices in the resources inventory classified as per 27 service categories and 12 service chapters (see Table 6 for service category and chapter codes)

4 Discussion

This deliverable presents an overview of the available resources that can be used to aid safe innovation in the field of nanotechnology. The inventory is not exhaustive, and does not question the value for purpose of the resources. It rather aims to be a useful overview in MS Excel workbook format, from which the user can select the resource, based on parameters and criteria important for them. Within this overview, a set of descriptive parameters is defined per resource type, and the descriptors are specified based on the information that is relevant to be included. Quality criteria are also included, to allow users to select or search for resources based on, for example, the organization that approved the standard (and thereby indirectly the procedures followed to come to a standard), the level of evaluation and validation of the resources or the acceptance of the resource in view of the REACH legislation. Within the developed inventory, the tools are not evaluated or ranked based on the descriptive parameters or quality criteria. It is up to the user of the overview to screen and select the tool(s), and the information provided in the MS Excel worksheets can be used for this purpose.

The overview analyzed 31 tools and methods, 13 trainings, 77 standards, 136 SOPs and 52 Guidance and Best practices. Each document is well documented and described with several parameters that can help the end-user to understand the object of the documents. There is a large number of Standards and SOPs that can help the end user to conduct testing on toxicity and eco-toxicity, or measurements in workplaces and environment. One important issue is the scarce number of trainings available. This scarcity could be seen as an opportunity for the future EC4SafeNano to identify the specific training needs and propose appropriate approaches for the end user(s).

The current analysis also reveals that the resources related to the environmental assessment of nanomaterials and nanotechnology are quite scarce. This aspect is covered only in 6 out of the 31 included tools, and 4 out of 52 Guidance and Best practices. One could, therefore, conclude that in aspects such as eco-toxicity and methodologies for the environmental risk assessment and life cycle assessment there is still need for deeper investigation.

After the project ends and the EC4SafeNano Centre is established, this inventory should be regularly updated, to include new information or updated versions of registered resources and/or new resources. The conceptual mechanisms to update the inventory are reported in D5.3, together with the mechanisms to update the inventories of needs and resources, and the catalogue of services. These mechanisms have been developed after collaboration of WP2 with WP3 and WP5.

References

[1] http://www.nanoreg2.eu/resources

[2] https://www.nanopartikel.info/en/

ANNEXES

Annex 1 T2.3 MS EXCEL DOCUMENT

Annex 1 T2.3 MS EXCEL DOCUMENT

The MS excel file is freely accessible at the following link:

http://www.ec4safenano2.eu-vri.eu/filehandler.ashx?path=EC4SafeNano/PROJECT/WP2/T2.2/D2-3_ANNEX1-Inventory_2019-09-27.xlsx