



**Deliverable 2.1**

Mapping the Scientific and Policy Landscape of PerMed in Europe and China to foster collaboration among the two Regions

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## Summary

A systematic mapping of available scientific papers, patents and funding programmes on Personalised Medicine in Europe and in China has been carried out in order to outline, in a comprehensive, transparent and objective manner, the R&I and funding landscape of Personalised Medicine in the two Regions and highlight the main areas in which cooperation is in place. In order to reduce the risk of an incomplete search, within the task 2.1 we have sought cooperation with Errequadro S.r.l., an IT company specialized in AI applied to business intelligence, in order to analyze the patents and papers on Personalised Medicine, and thus offer to Sino-EU PerMed strategic information for the activities to come.

Regarding the mapping of Funding Programs on Personalised Medicine in EU, we have based the work on the survey conducted by IC-PerMed in the previous years, which is available at the following online database: <https://www.icpermed.eu/app/login>. The database provided an extensive overview of the funding activities in EU. For what concerns Funding Programmes in China we have carried out a twofold activity: on one side we have shared a survey with the Chinese stakeholders whose contacts have been collected with the support of our partners as well as the support of the IC2PerMed partners. In addition, since the level of interaction was considered low, we have carried out a desk research to better understand the level of collaboration between the two Regions in this context.

## Keywords

Patent Mapping, Scientific Mapping, Personalised Medicine , Precision Medicine, Preventive Medicine, Systems Biology, Stratified Medicine, Targeted Therapy, Tailored Treatment/Therapy, Deep Phenotyping, Omics Sciences, Big Data, Machine Learning Techniques , Traditional Chinese Medicine

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## The Sino-EU-PerMed Project

Personalised Medicine (PM) approaches bring along immense potentials to improve diagnosis and treatment of diseases and prevention strategies by taking into account individuals' geno- and phenotypes, biomedical, life style or environmental data. The International Consortium for Personalised Medicine (ICPerMed) is a member state-driven initiative of over 40 international ministries and funding agencies. The European Commission (EC) is an active observer and supports by funding several related projects. ICPerMed aims at aligning efforts in all areas of PerMed by fostering international coordination of research and innovation funding.

To support these efforts “Widening Sino-EU policy and research cooperation in Personalised Medicine” (Sino-EU-PerMed) aims at connecting ICPerMed strategies and activities with relevant Chinese stakeholders. To achieve this goal the Sino-EU-PerMed will disseminate and coordinate the following activities. Inventory and analysis of the PerMed landscape in China through a mapping. In addition the Sino-EU-PerMed consortium will exchange expertise and experts through workshops and delegation trips to China and in Europe. Thereby we will gain a better mutual understanding of PerMed activities and related cultural aspects as well as health economics issues. By establishing technical taskforces

and running a series of targeted workshops, Sino-EU-PerMed will promote international standards and pave the way for future communication, collaboration and undertakings. Therefore the implementation of a dissemination plan is an essential part of the project.

Our consortium and activities aim at maximising the unique and long-term impact PM approaches have on cooperation and are aligned with ICPerMed. The cooperation with China in the forms described within the Sino-Eu PerMed will allow the International consortium for Personalised Medicine to further strengthen Europe's leading role in this area and contribute to a successful implementation of PerMed in the global context and foster joint PerMed projects between Europe and China.

## List of Abbreviations

<b>Abbreviation</b>	<b>Explanation</b>
PM	Personalised Medicine
PPT	PowerPoint presentation
R&I	Research and Innovation
Sino-EU PerMed	Acronym of the Project “Widening Sino-EU policy and research cooperation in Personalised Medicine”
WP	Work Package
PubMed	Free search engine accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics
EPO	European Patent Office
MeSH	Medical Subject Headings
IPC	International Patent Classification
TCM	Traditional Chinese Medicine
NKPs	Chinese National Key R&D Programmes

## 1. Introduction

The aim of Task 2.1 is identifying the state of art of the collaboration between Europe and China in Personalised Medicine (PM). A systematic mapping of the relevant documents has been carried out to

1. describe, in a comprehensive and detailed manner, the Research and Innovation (R&I) landscape of Personalised Medicine (PM) in China,
2. identify the main areas in which R&I is being performed between Europe and China and
3. map the main stakeholders cooperating in the two regions around whom the Sino-EU PerMed will unfold itself in the next years.

### Patent documents

Patent analysis has been performed by mining the European Patent Office Database (Espacenet), which contains data on more than 120 million patent documents from around the world, with the aim to:

1. Identify patent applications which fall under the umbrella of PM in Europe and China;
2. Identify the main technological players in the field of personalised medicine globally, in Europe and in China;
3. Set and track the terms of collaboration in the technological filed between Chinese and European players (co-assigned patents or patents collaborations);
4. Map the main technological areas of collaboration and the entities which are collaborating on PM.

### Scientific publications

The second part of the mapping has been focused on scientific publications using PubMed (the free search engine for Medical Literature online database of references and abstracts on life sciences and biomedical topics) to establish the state of art of collaboration in the scientific field between Europe and China. The objectives of the mapping are to:

1. Identify the publications which fall under the umbrella of PM globally, in Europe and in China
2. Identify the main scientific players in the field of PM in Europe and in China
3. Set the terms of collaboration in the scientific field between Chinese and European innovators (co-assigned patents or patents collaborations);
4. Map the main scientific disciplines as well as the main scientific institutions from the two regions collaborating on personalised medicine

### Funding Programmes

The third part of the mapping has been focused on funding programmes with the goal of understanding the main differences in funding schemes and project size in EU and China and therefore having a better idea on how collaboration between Chinese stakeholders could take place within IC-PerMed.

The outcomes of the scientific and technological mapping have been included in an ad-hoc database which can be browsed by the project partners at any time and will be updated every 24 months.

## 2. Patents mapping

### 2.1. Operative Flow

#### 2.1.1 Definition of Personalised Medicine

The mapping activity has started with the identification of a valid definition of “Personalised Medicine” and the selection of keywords, as inclusive as possible, of the overall scopes and characteristics of PM to be used in the query (request of information retrieved from a database) to mine the European Patent Office Database. The searching approach was also devised to enrich and refine the results iteratively.

As PM is usually used as a catch-all term, and in order to develop a scientifically sound approach, we have selected the following definitions:

1. **Personalised medicine:** a medical model using characterization of individuals’ phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) for tailoring the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention, which makes the 4P medicine concept (European Council Conclusion 2015/C 421/03))
2. **Precision medicine:** treatments targeted to the needs of individual patients on the basis of genetic, biomarker, phenotypic or psychosocial characteristics that distinguish a given patient from other patients with similar clinical presentations” (Precision medicine--personalized, problematic, and promising. Jameson JL, Longo DL N Engl J Med. 2015 Jun 4; 372(23):2229-34.)  
Focus on process and used data: precision medicine as “a model that integrates clinical and other data to stratify patients into novel subgroups.
3. **Personalised health care & Precision public health:** the application of clinical know-how, concepts of systems medicine, and personalised medicine technologies to improve health and minimize disease.

To better tailor the searching to the EPO database, we have established that the goal of personalised medicine can be:

- Diagnostics
- Design of patient-specific therapy/treatment strategy
- Forecast of success of therapy/treatment strategy

In addition, we have assumed that the tools of personalised medicine are genetic analysis, statistical analysis, patient-specific treatment, patient-specific drug.

We have then identified the following main **keywords** to be used within the searches: personalised medicine, personalized medicine, precision medicine, preventive medicine, predictive medicine, systems biology, systems medicine, stratified medicine, targeted therapy, tailored treatment/therapy, deep phenotyping, omics sciences, big data, machine learning techniques.

Once the query has been developed, all the patent documents coherent with the definitions and keywords deployed have been retrieved and a first patent dataset has been defined. This dataset has been further

refined by manually eliminating the documents which, despite falling into the dataset, were clearly not coherent with the definitions and approaches of PM.

Particularly, considering the wide range of results emerged from the first not-refined dataset, it has been decided to define it more into detail and apply some filters, starting by assumptions related to what PM is and what it is not:

**PM is:**

- Drugs, devices, methods for patient-tailored treatment/therapy
- Procedures using an individualized approach based on genetic evaluation and treatment
- Treatment strategies based on individual data of patient genotype, phenotype, lifestyle
- Methods for synthesizing or designing customized and patient-specific drugs
- Methods for predictive medicine (e.g. statistical method for predicting life expectation, therapy response based on patient genotype, phenotype, lifestyle)

**PM is not:**

- Customized prosthesis/implants
- Medical instrument designed for specific group of patients (e.g. obese patients)
- Diagnostic, therapeutic and prophylactic approaches for a specific disease (and not for a specific patient)
- Genetic analysis for general purposes

**Other fields excluded:**

- Veterinary
- Personalised nutrition plans

Through the indications related to the national validations of the patents contained in the dataset, it was possible to divide the dataset in two Areas: Europe and China.

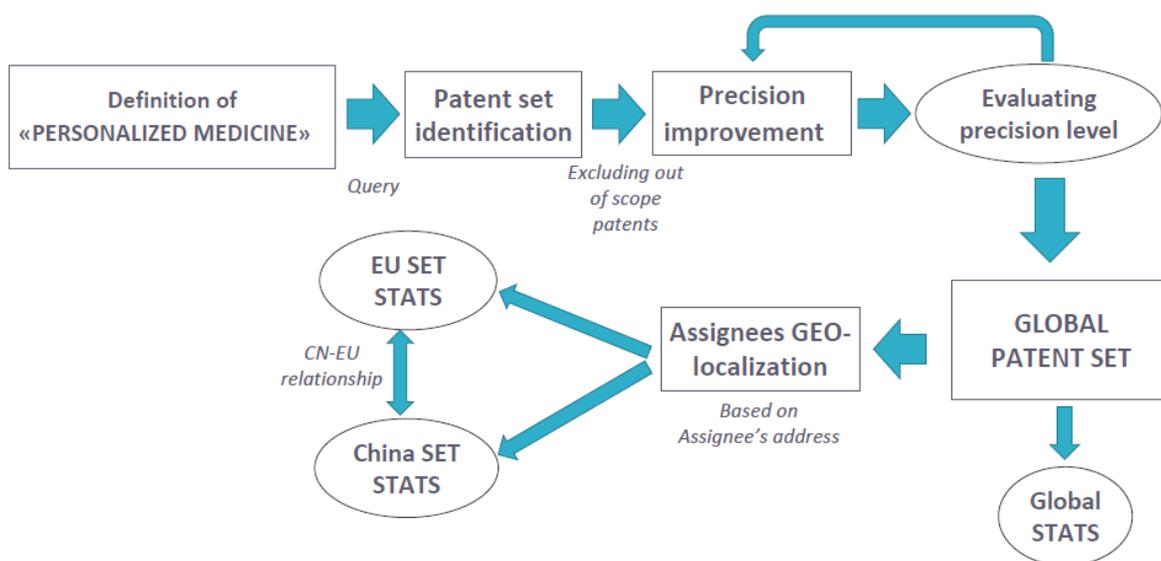


Figure 1. Mapping Workflow: It depicts how we have developed the global, European and Chinese patents dataset

## 2.2. Global Patent Set

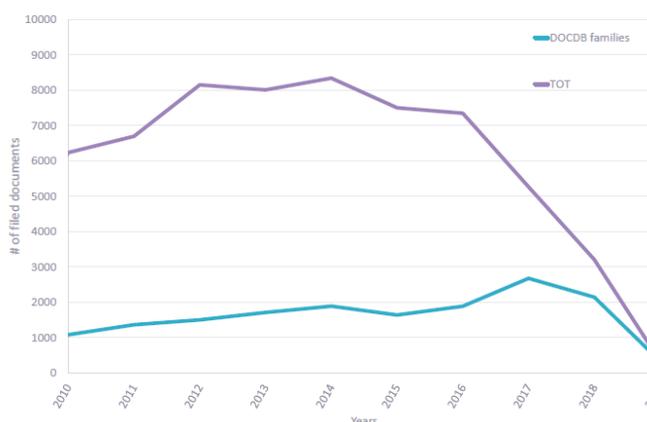
The results emerged from the first round of querying showed the following statistics on patents in PM worldwide:

- ~73000 patents
- ~12000 patent families (this set has been used for classification)
- 94.5% of precision (or positive predictive value) is the fraction of relevant patents among the global patent set. We have performed the precision check manually on a statistical sample of 270 documents (calculated as square root of 73000)
- High level of recall
- Innovation Index  $\rightarrow$  I.I. = #patents/#patent families
- Innovation Index Global Patent Set = 6.1
- Innovation Index Precision Medicine = 6.0

As planned within Grant Agreement of the Project, the mapping has covered the decade 2010 – 2019.

In this first analysis, the application of the query has shown that the patenting activity has generally increased from 2010 (~6000 documents filed) to 2019, with peaks in 2012 and 2014 (~8000 documents), then slowly decreased from 2016 (~7000 documents) to 2017 (~5500 documents).

Years 2018 and 2019 are not trustable due to the secrecy times for patent applications. The analysis has also shown that assignees of a patent are either private companies or public research institutes.

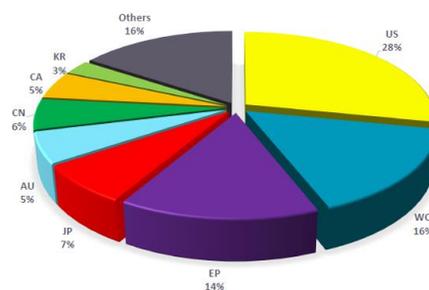


Graph 1. Global Patent Filing on Personalised Medicine between 2010 and 2019

Table 1 and Graphs 2 and 3 display the patenting activity in PM by country. They show a higher concentration of patent applications in the United States, followed by Europe, Japan and China.

It is also clear that the patenting activity (which can be a primary indicator for innovation in PM) is mainly pursued by for profit enterprises (~60% of total patents applications), followed by universities (~25%), and finally by other categories (i.e. non-profit, hospitals, government for around ~15%).

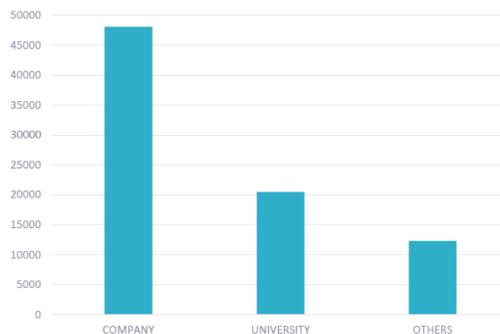
The main assignees are the Harvard University (US), Roche (CH), University of California (US), Inserm (FR), Genentech (US) and Novartis (CH) among others.



Graph 2. Global Patent Activity by Country

#	Assignee	# of Families	# of Patents	I.I.	Headquarters (Country)
1	Harvard University	432	1374	3,2	Cambridge (USA)
2	Roche	411	1611	3,9	Basilea (Swisse)
3	Univ. of California	319	1054	3,3	Berkeley (USA)
4	Inserm	251	734	2,9	Paris (France)
5	Genentech	226	1250	5,5	San Francisco (USA)
6	Novartis	206	1018	4,9	Basilea (Swisse)
7	Philips	187	478	2,6	Amsterdam (Netherlands)
8	John Hopkins University (JHU)	186	629	3,4	Baltimore (USA)
9	Stanford University	186	582	3,1	Stanford (USA)
10	Univ. of Texas	156	510	3,3	Austin (USA)
11	CNRS	145	439	3,0	Paris (France)
12	Memorial S. Kettering Cancer Center	134	432	3,2	New York (USA)
13	Immatics Biotech.	126	514	4,1	Tuebingen (Germany)
14	Medtronic	121	431	3,6	Dublino (Ireland)
15	University of Michigan	112	358	3,2	Ann Arbor (USA)

Table 1. Global Patent Assignees



Graph 3. Patenting Activity by type of Organisation (Private, Public, Other)

### IP Classes

The International Patent Classification (IPC) provides for a hierarchical system of language independent symbols for the classification of patents according to the different areas of technology to which they pertain. We have categorized and listed the main classes for which patents are applied, in decreasing order, as shown in Table 2.

#	Class	# of families	# of patents	Class description
1	G01N	7197	27085	Investigating or <b>analysing materials</b> by determining their chemical or physical properties
2	A61K	7067	27545	Preparations for <b>medical</b> , dental, or toilet purposes
3	C12Q	6555	23644	Measuring or testing processes involving <b>enzymes, nucleic acids or microorganisms</b> . Compositions or test papers therefor; processes of preparing such compositions; condition-responsive control in microbiological or enzymological processes
4	A61P	4368	14916	Specific therapeutic activity of chemical compounds or medicinal preparations
5	C12N	3027	9654	Microorganisms or enzymes; compositions thereof . propagating, preserving, or maintaining microorganisms; mutation or <b>genetic engineering; culture media</b>
6	C07K	2957	11531	<b>Peptides</b>
7	G06F	2724	8350	Electric digital <b>data processing</b>
8	A61B	1782	5560	<b>Diagnosis</b> ; surgery; identification
9	C40B	1103	2275	<b>Combinatorial chemistry</b> ; libraries, e.g. chemical libraries, in silico libraries
10	G06Q	1015	3024	<b>Data processing</b> systems or methods, specially adapted for administrative, commercial, financial, managerial, supervisory or forecasting purposes; systems or methods specially adapted for administrative, commercial, financial, managerial, <b>supervisory</b> or <b>forecasting</b> purposes, not otherwise provided for

Table 2. Global IPC Classes of Patent Filing

### 2.2. EU-CN Comparison

After gathering an overview of the patenting activity at a global level, we have filtered the results to focus on a detailed comparison between EU and China.

For this purpose, as a first step we defined EU countries as follows:

#### EU Countries:

- ✓ European Union Member States
- ✓ European Free Trade Association
- ✓ European Economic Area

- √ Canada<sup>1</sup>
- √ Israel<sup>1</sup>
- ✗ Balkan Countries (other than Croatia, Greece)

**Included in Statistics**

Austria, Belgium, Canada, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Latvia, Lithuania, Liechtenstein, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Spain, Slovenia, Sweden, Switzerland, United Kingdom.

**Excluded from Statistics**

Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Kosovo, Macedonia, Moldova, Monaco, Montenegro, Russia, San Marino, Serbia, Turkey, Ukraine, Vatican City.

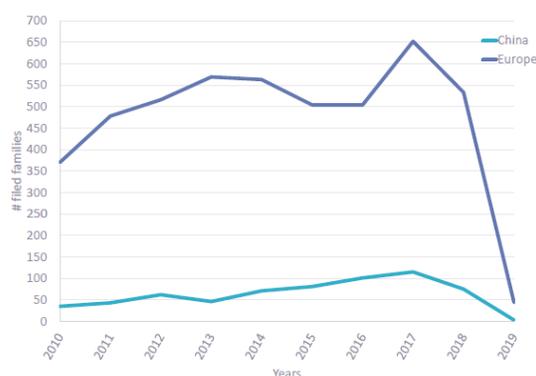
The comparison has started by analyzing the patent activity along the time periods selected for the mapping.

The trend for 2018 and 2019 cannot be considered reliable considered that patent applications are kept secret for 18 months from the filing date or from the priority date, and therefore the information may not be complete for those years at the time of submission of this report is made. In Graph 4 we can clearly see that PM patenting activity is more active in Europe than in China, with peaks of number of filed families of ~650 and ~100 respectively in 2017.

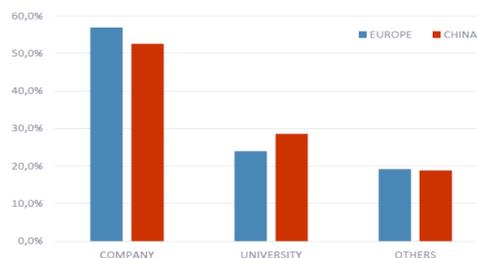
An analysis and comparison between EU and China has been based on the type of filing institutions that can be either private companies or public research entities.

Graph 5 shows that in EU countries patent filing on PM is mostly done by private companies, while in China Universities play a major role.

The key players in the EU are Roche (Switzerland), Inserm (France), Novartis (Switzerland), Philips (Netherlands), CNRS (France), Immatics Biotech (Germany), while in China we have University of Hong Kong (Hong Kong), Fudan University (Shanghai), BGI Shenzhen Company (Beijing), Chinese Academy of Sciences (Beijing), Sun Yat Sen University (Guangzhou).



**Graph 4. Patenting Trend – Comparison between Europe and China**



**Graph 5. Patenting Activity by type of Organisation (Private, Public, Other) - Comparison between Europe and China**

<sup>1</sup> We have decided to include Canada and Israel in the group of the European Countries due to their strong participation in the European networks on PM (IC-PerMed and ERA-PerMed)

Main European Assignees

#	Assignee	# of Families	# of Patents	I.I.	Headquarters (Country)
1	Roche	357	1343	3,8	Basilea (Swisse)
2	Inserm	247	691	2,8	Paris (France)
3	Novartis	182	858	4,7	Basilea (Swisse)
4	Philips	204	499	2,4	Amsterdam (Netherland)
5	CNRS	136	394	2,9	Paris (France)
6	Immatics Biotech..	114	447	3,9	Tuebingen (Germany)
7	Siemens	98	184	1,9	Munchen (Germany)
8	Nestec	91	400	4,4	Vevey (Swisse)
9	Varian Medical Systems	62	109	1,8	Zug (Swisse)
10	Université Rene Descartes	55	119	2,2	Paris (France)
11	University Of London	52	147	2,8	London (UK)
12	University Of Cambridge	46	198	4,3	Cambridge (UK)
13	Ass. Publique Hopitaux De Paris	44	115	2,6	Paris (France)
14	University Health Network	37	89	2,4	Totonto (CA)
15	B.R.A.H.M.S.	33	121	3,7	Berlin (Germany)

Table 3. Patents Main EU Assignees

Not European Main Assignees (Coassigned patent)

#	Co-Assignees	# of Families	# of Patents	I.I.	Country
1	Genentech	83	190	2,2	USA
2	Harvard University	43	127	2,9	USA
3	Univ. Of California	16	33	2,1	USA

Main Chinese Assignees

#	Assignee	# of Families	# of Patents	I.I.	Headquarters (Country)
1	University Of Hong Kong	35	73	2,1	Honk Hong
2	Fudan University	15	27	1,8	Shanghai
3	BGI Shenzken Company	14	37	2,6	Beijing
4	Chinese Academy Of Sciences	14	26	1,9	Beijing
5	Sun Yat Sen University	14	17	1,2	Guanzhou
6	Chengdu Xinjin Shifeng Med.App.Instr.	9	9	1,0	Chengdu
7	CROWN Bioscience	8	20	2,5	Taicang
8	Peking University	7	7	1,0	Beijing
9	Xiamen University	6	17	2,8	Xiamen
10	Kunming Univ. of Science and Technology	5	9	1,8	Kunming

Table 4. Patents Main Chinese Assignees

Not Chinese Main Assignees (Coassigned patent)

#	Co-Assignees	# of Families	# of Patents	I.I.	Country
1	IBM	14	14	1	USA
2	Enanta Pharmaceuticals	13	27	2,1	USA
3	Bio Merieux	5	12	2,4	France
4	Academia Sinica	5	6	1,2	Taiwan

In an attempt for a more detailed overview on patenting activity in EU, we decided to highlight countries where the headquarters of the assignees are based. It has emerged that these are mainly located in Germany (19,5%), followed by Switzerland (16,4%), France (13,1%), United Kingdom (12,0%), Canada (8,4%) and Israel (6,2%).

An analysis has also been performed to check how many EU-owned patents have been extended in China and vice versa, as an indication of a market interest for PM solutions. It emerged that around 3,7% of EU-owned patents are filed in China and around 9,8% of Chinese-owned patents are filed in an EU country, as shown in Figure 3.

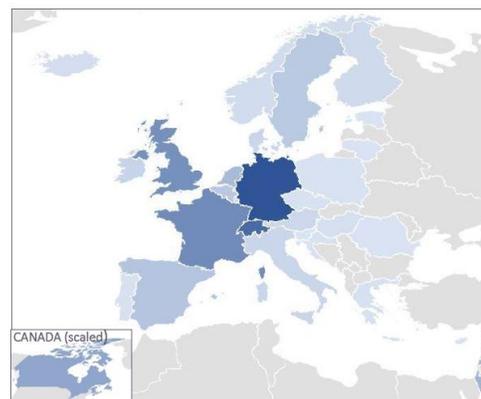


Figure 2. EU Assignees Headquarters by Country

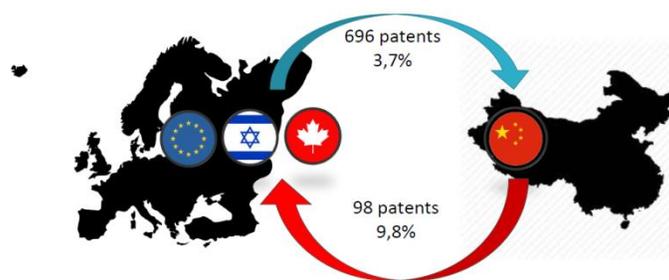


Figure 3. Patents Filing from EU to CN and vice versa

## 2.4. EU-CN Collaboration

After identifying the main players in PM both in EU and China, a deeper analysis was performed to find patents derived from cooperation between EU and China and to understand the level of collaboration on PM technologies between the regions.

For this purpose, we have assumed that cooperation on patents happen in case of:

1. **Co-assignment:** a patent family having at least 1 Chinese assignee and 1 EU assignee
2. **Collaboration:** a patent (or set of patents) linked to a patent family having at least 1 Chinese assignee and 1 EU assignee

The application of these criteria has shown 26 EU-CN co-assigned patents and 140 EU-CN collaboration patents. In both sets, the main EU country players are France, United Kingdom and Switzerland. In Tables 5 and 6 there is an overview on the main private/public assignees for both regions.

#	Country	# of Fam.	# of Patents	#	Assignee (Companies and research institutes)	# of Fam.	# of Patents	Country
1	France	8	68	1	IBM (CHINA)	7	25	China
2	United Kingdom	7	25	2	IBM (GERMANY)	7	25	Germany
3	Switzerland	4	41	3	Biomerieux	3	23	France
4	Israel	3	6	4	Inserm	3	14	France
5	Germany	2	17	5	Pathway pharmaceuticals	3	6	China
6	Canada	2	14	6	Novartis	2	20	Switzerland
7	Cyprus	1	14	7	BASF (CHINA)	2	17	China
				8	BASF (Germany)	2	17	Germany
				9	Institut Pasteur	1	12	France
				10	C.N.R.S.	2	2	France
				11	Hospices civils de Lyon	2	2	France
				12	Shanghai Univ.	2	2	China
				13	Xigen Inflammation	1	14	Cyprus
				14	Arius Research	1	14	Canada
				15	ROCHE	1	12	Switzerland
				16	Philip Morris	1	9	Switzerland
				17	Canada Cancer and Aging Lab.	1	2	Canada

Table 5. Collaboration on patents between EU and CN

#	Country	# of Patents	#	Assignee (Companies and research institutes)	# of Patents	Country
1	France	19	1	Biomérieux	7	France
2	United Kingdom	6	2	IBM (CHINA)	7	China
3	Switzerland	6	3	IBM (UK)	6	UK
4	Canada	5	4	PATHWAY PHARMACEUTICALS	4	China
5	Israel	4	5	Roche	4	Switzerland
6	Germany	3	6	INSERM	4	France
			7	BASF (DE)	2	Germany
			8	BASF (CN)	2	China
			9	CNRS	2	France
			10	INSTITUT PASTEUR	2	France
			11	HOSPICES CIVILS DE LYON	2	France
			12	UNIVERSITE CLAUDE BERNARD LYON 1	2	France
			13	IBM (DE)	1	Germany
			14	Arius research	1	Canada

Table 6. Co-assignment of patents between EU and CN

We were also able to track the cross-collaboration matrix which uncovers the transversal collaboration between two cooperating entities on the same patents.

### 2.5. Traditional Chinese Medicine

Traditional Medicine (TCM) is an ancient system of health and wellness that has been used in China for thousands of years which looks at the overall well-being of people. Since its use is very well represented, we decided to extend the PM search also to this medical field to encompass this specificity and understand whether relevant technological activity on PM was being carried out under the umbrella of TCM.

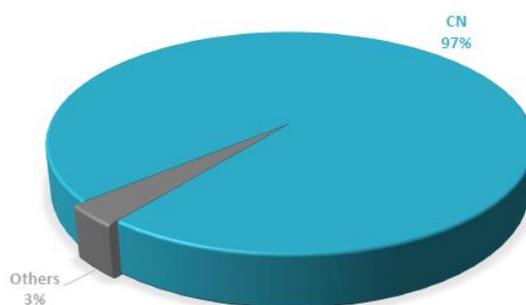
“Traditional Chinese Medicine” has been included in the definition of Personalised Medicine as follows:

- Procedures of Traditional Chinese Medicine (defined as a branch of “alternative medicine” in Western world)
- Acupuncture, cupping therapy, moxibustion, reflexology
- Traditional Chinese herbal medicine
- Traditional Chinese massage methods and instruments
- Procedures or instruments declared as Traditional Chinese Medicine in the relevant patents.

A set of ~197000 patents (~175000 families) has been found, with a level of precision of about 97%. A peak of patents related to Traditional Chinese Medicine has been registered around 2015, filed by CN companies/institutions in 97% of the cases.



Graph 6. Trend of patent filing related to Traditional Chinese Medicine



Graph 7. Countries filing patents related to Traditional Chinese Medicine

It has been also confirmed that for Traditional Chinese Medicine most patents have been filed by Universities or public institutions rather than private companies.

Including Traditional Medicine in Personalised Medicine as defined above, we found 206 Patents that met PM and TCM criteria.

#	Assignee	# of Families	# of Patents	Country
1	Guangxi University	591	618	China
2	Henan University	537	669	China
3	Chengdu Feilong Water Treatment Tech. Institute	434	434	Cina
4	Sichuan Jintang Haina Biomedicine Tech. Institute	371	371	China
5	Qingdao Xinlide Trad. Chin. Med. Technology Research	324	324	China
6	Nanjing University Of Chinese Medicine	309	403	China
7	Beijing Lvyuan Qiuzheng Tech. Develop. Company	258	258	China
8	Suzhou Tianling Chin. Trad. Med.	255	273	China
9	Qingdao Municipal Hospital	249	316	China
10	Hunan University Of Chinese Medicine	222	237	China

Table 7. Main Assignees of patents on Traditional Chinese Medicine

### 3. Scientific Literature Mapping

#### 3.1 Operative Flow

The approach and process undertaken for Scientific Literature Mapping follow the same logic of patent searches with some adaptations to the PubMed database.

PubMed comprises more than 26 million citations for biomedical literature from MEDLINE, life science journals, and online books and is a free and public database. We started with the definition of “Personalised Medicine” to build the query for searching for articles on the database.



Figure 4. Workflow for scientific mapping

The QUERY STRATEGY has been based on a hybrid approach, merging two different sets:

- Set 1) “precision medicine” and “personalised medicine” as MeSH terms<sup>2</sup>
- Set 2) customized query (the one elaborated for the Patent Database), using the keywords highlighted above

This set included non-English written articles only if at least one of title, abstract or keyword are available in PubMed in English.

Regarding the time frame, we have included all the publications between 2010 and 2020. Nevertheless, as the analysis of the database has been conducted in the first quarter of 2020, the set of papers for 2019 and 2020 may not be complete.

In order to have a more precise and reliable dataset we also used the following filters:

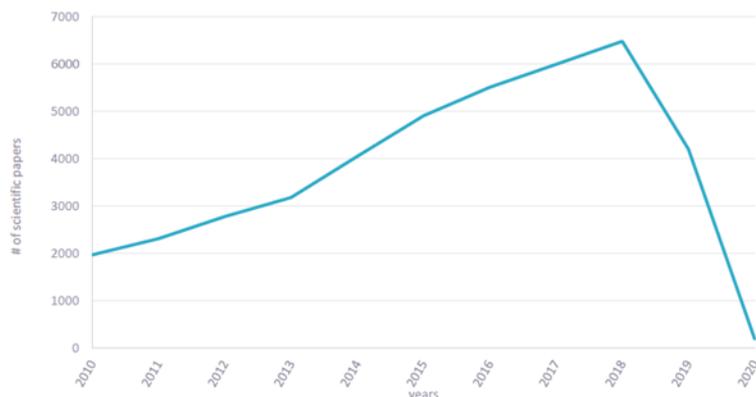
- **Human**
- **Years from 2010 to 2020**

As a result, we had a total of 41535 scientific papers (200835 affiliations) which fall under our umbrella of personalised medicine.

The results that emerged from the query have been downloaded in as .xls format including information about authors, affiliation, year of publication, journal, volume, etc. More precisely, the global paper set has been downloaded in a Medline format and through EndNote (a commercial reference management software used to manage bibliographies and references when writing essays and articles) This programme outputs the information in Excel format.

The quantitative analysis has shown that from 2010 there has been a constant increase of publications related to Personalised Medicine, with a peak in 2018. The PubMed database is updated periodically and data for the last two years could not be comprehensive and accurate.

<sup>2</sup> Untagged terms that are entered in the PubMed search box are automatically mapped to the MeSH vocabulary when a match is found.



Graph 8. Global trend of scientific publications

The mapping has proceeded following: 1) global paper set analysis 2) EU-CN compared statistics and 3) EU-CN collaboration.

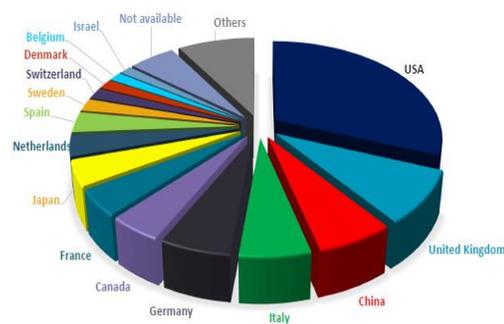
### 3.2 Global paper set analysis

Firstly, we assumed that a scientific article is assigned to a Country if at least an author’s affiliation from that Country is present. Following this approach, the global patent set has shown that the most active countries in Personalised Medicine are the United States (16108 papers), the United Kingdom (4576 papers), China (3307 papers), Italy (3019 papers), Germany (3001 papers), Canada (2274 papers), France (2268 papers) and the Netherlands (2216 papers) among others, as shown in Graph 9.

Analysing the same data set by number of affiliations in each Country (in a paper more affiliations from the same country can be present) active in PM-related articles publication, the United States confirmed to be on top with 58639 affiliations with a 29,2% of total papers published, followed by the United Kingdom (15131 affiliations and 7,5% of total papers), China (with 10178 affiliations and 5,0% of total papers). The total set is summarized in Table 8 and Graph 10.

#	Country	# of affiliations	% of total papers
1	USA	58639	29,2%
2	UK	15131	7,5%
3	China	10178	5,0%
4	Germany	10127	5,0%
5	Italy	9143	4,5%
6	France	8577	4,2%
7	Japan	7224	3,6%
8	Netherlands	6638	3,3%
9	Canada	6335	3,1%
10	Spain	6052	3,0%
11	Denmark	2737	1,3%
12	Sweden	2571	1,2%
13	Swisse	2096	1,0%
14	Finland	1874	0,9%
15	Poland	1561	0,7%

Table 8. Countries listed by number of affiliations publishing on PubMed



Graph 9. Main countries publishing on Personalised Medicine

#	Journal	# of papers	Impact Factor (2018)
1	Pharmacogenomics	2179	2.265
2	PLoS One	825	2.776
3	Clinical Pharmacology & Therapeutics	395	6.336
4	Scientific reports	380	4.122
5	Oncotarget	314	4.525
6	Nature	283	43.070
7	International Journal of Molecular Sciences	243	4.183
8	Methods in Molecular Biology	239	10.71
9	Pharmacogenetic & Genomics	231	1.90
10	Clinical Cancer research	221	8.911

Table 9. Main Journals publishing on PM

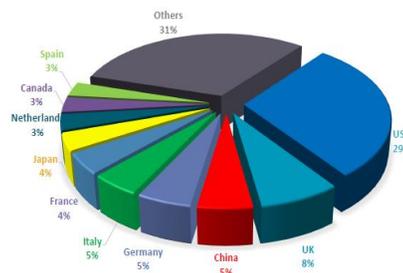
Regarding the Journals publishing articles on PM, the Journal of Pharmacogenomics ranks at the top with 2179 published papers, followed by PLoS One with 825 papers, the Journal of Clinical Pharmacology & Therapeutics with 395 papers, the Scientific Report with 380 papers, Oncotarget with 314 and Nature with 283 papers between the others.

### 3.3 EU-CN compared statistics

In order to perform a comparison on scientific publication between EU and CN, coherently with the patent search, we have used the same group of EU Countries (Austria, Belgium, Canada Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Liechtenstein Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Romania, Slovenia, Sweden, Switzerland, UK.).

It emerged that the global set of articles contains around 41535 articles, 16823 of which have an EU affiliation and 3307 CN.

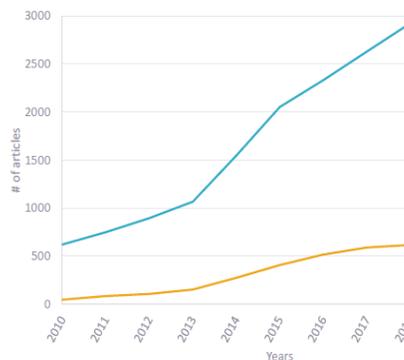
Graph 10 shows the trend of scientific publication related to PM in EU and China. The trend is constantly increasing, with peaks in 2013, 2015 and 2018 both for EU and China. Looking deeper into the affiliation countries, it emerged that the most active EU area is the United Kingdom (18,20% of total EU papers published), followed by Germany (12,18%), Italy (10,99%), France (10,31%), the Netherlands (7,58%) and Canada (7,62%) between the others. Most of the articles are published by Universities or Research Centres, both in EU and China.



Graph 10. Most active countries in the publication of articles related to PM

Area	# of Articles	# of Affiliations
Global SET	41 535	200 835
European Affiliation	16 823	83 157
Chinese Affiliation	3 307	10 178

Table 10. Global set of articles



Graph 10. Trends in the publication of articles on PM

In Figure 6 we can see highlighted in darker blue the most active countries publishing articles relating to Personalised Medicine.

#	Assignee	# of Affiliations	% (total EU papers)
1	U.K.	15131	18,20%
2	Germany	10127	12,18%
3	Italy	9143	10,99%
4	France	8577	10,31%
5	Netherlands	6638	7,98%
6	Canada	6335	7,62%
7	Spain	6052	7,28%
8	Denmark	2737	3,29%
9	Sweden	2571	3,09%
10	Swisse	2096	2,52%
11	Finland	1874	2,25%
12	Poland	1561	1,88%
13	Belgium	1534	1,84%
14	Israel	1492	1,79%
15	Austria	1055	1,27%

Table 11. Main countries publishing on PM by number of affiliations

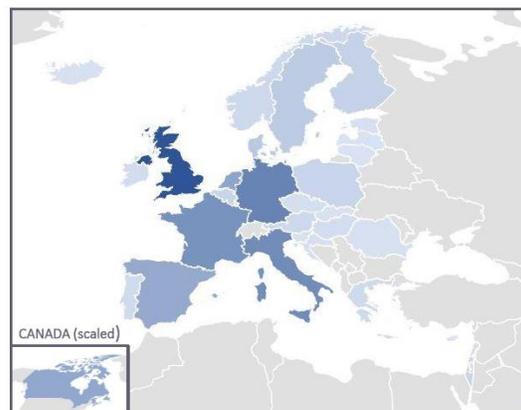


Figure 5. Main Countries publishing on PerMed by number of affiliations

#	Affiliation	# of papers	Country
1	Wellcome Trust Centre for Human Genetics, University of Oxford, Oxford, UK.	178	UK
2	Department of Epidemiology, Erasmus Medical Center, Rotterdam, the Netherlands.	88	Netherlands
3	Centre for Cancer Genetic Epidemiology, Department of Public Health and Primary Care, University of Cambridge, Cambridge, UK.	76	UK
4	Department of Human Genetics, Radboud University Medical Center, Nijmegen, The Netherlands.	74	Netherlands
5	National Institute for Health and Welfare, Helsinki, Finland.	65	Finland
6	Department of Internal Medicine, Erasmus Medical Center, Rotterdam, the Netherlands.	65	Netherlands
7	Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden.	64	Sweden
8	German Cancer Consortium (DKTK), German Cancer Research Center (DKFZ), Heidelberg, Germany.	63	Germany
9	Estonian Genome Center, University of Tartu, Tartu, Estonia.	58	Estonia
10	German Center for Diabetes Research (DZD), Neuherberg, Germany.	54	Germany
11	Section of Pharmacogenetics, Department of Physiology and Pharmacology, Karolinska Institutet, Stockholm, Sweden.	52	Sweden
12	Department of Clinical and Experimental Medicine, University of Pisa, Pisa, Italy.	49	Italy
13	Institute for Molecular Medicine Finland, University of Helsinki, Helsinki, Finland.	48	Finland
14	Department of Biostatistics, University of Liverpool, Liverpool, UK.	46	UK
15	Institute of Human Genetics, Technische Universität München, Munich, Germany.	41	Germany
16	Division of Cancer Epidemiology, German Cancer Research Center (DKFZ), Heidelberg, Germany.	40	Germany
17	Department of Molecular Genetics, University of Toronto, Toronto, Ontario, Canada.	38	Canada
18	Icelandic Heart Association, Kopavogur, Iceland.	37	Iceland
19	Department of Clinical Medicine, Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark.	36	Denmark
20	Department of Genetics and Pathology, Pomeranian Medical University, Szczecin, Poland.	36	Poland

Table 12. EU Main affiliations publishing on PerMed

#	Affiliation	# of papers
1	Department of Clinical Pharmacology, Xiangya Hospital, Central South University, Changsha	320
2	Institute of Clinical Pharmacology, Hunan Key Laboratory of Pharmacogenetics, Central South University, Changsha	151
3	Institute of Genomic Medicine, Wenzhou Medical University, Wenzhou	106
4	National Clinical Research Center for Geriatric Disorders, 8Xiangya Road, Changsha 410008, Hunan.	52
5	Beijing Institutes of Life Science, Chinese Academy of Sciences, Beijing	49
6	BGI-Shenzhen, Shenzhen	49
7	Hunan Province Cooperation Innovation Center for Molecular Target New Drug Study, Hengyang	44
8	Bio-X Institutes, Key Laboratory for the Genetics of Developmental and Neuropsychiatric Disorders, Ministry of Education Shanghai Jiao Tong University, Shanghai	34
9	Department of Pharmacy, Xiangya Hospital, Central South University, Changsha	31
10	Engineering Research Center of Applied Technology of Pharmacogenomics, Ministry of Education, 1Xiangya Road, Changsha 410078, PR China	31
11	Department of Epidemiology, Shanghai Cancer Institute, Shanghai, China.	28
12	State Key Laboratory of Ophthalmology, Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou 510060, China.	25
13	Institute of Genomic Medicine, College of Pharmacy, Jinan University, Guangzhou 510632, China.	24
14	Center for Systems Biology, Soochow University, No. Shizi Street, Suzhou, Jiangsu, 215006, China. bairong.shen@suda.edu.cn.	22
15	Beijing Tongren Eye Center, Beijing Tongren Hospital, Capital Medical University, Beijing, China.	21
16	Key Laboratory of High Altitude Environment and Genes Related to Diseases of Tibet Autonomous Region, School of Medicine, Xizang Minzu University, Xianyang, Shaanxi 712082, China	21
17	CAS Key Laboratory of Genome Sciences and Information, Beijing Institute of Genomics, Chinese Academy of Sciences, Beijing 100101, China	20
18	State Key Laboratory of Oncology in South China	16
19	Institute of Preventive Genomic Medicine, School of Life Sciences, Northwest University, Xi'an, 710069, China	16
20	Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University, Beijing, China.	15

Table 10. Chinese main affiliations publishing on PerMed

**3.4 EU – CN Collaboration**

In order to set the terms of collaboration for scientific publication mapping, we established that a collaboration between EU and CN happens when a scientific publication has at least 1 co-author with a Chinese affiliation and at least 1 co-author with a European affiliation.

By applying this definition to the global paper set, it has emerged that we have:

- 434 total collaboration papers, representing 1,1% of global papers set
- 13,1% of total Chinese papers
- 2,6% of total EU papers

The EU countries publishing articles in collaboration with China are the United Kingdom (220 articles), Germany (160), Canada (154), France (136), Italy (127) and the Netherlands (127) between others.

#	Country	# of collaboration
1	UK	220
2	Germany	160
3	Canada	154
4	France	136
5	Italy	127
6	Netherlands	127
7	Sweden	104
8	Denmark	93
9	Spain	87
10	Israel	71
11	Finland	70
12	Switzerland	60
13	Belgium	57
14	Austria	53
15	Greece	52

**Table 12. Main EU Countries publishing in collaboration with CN**



**Graph 11. Trend of collaborations with CN per EU Country**

The top 10 affiliations which are more active in joint publications are listed in Table 14. Considering that the final goal is to highlight key stakeholders in order to involve them in the workshop due in Work Package 2 and in all the activities related to Work Package 3, the last step of the mapping was focused on collecting the contacts of the main European and Chinese co-authors. For each paper we identified the corresponding authors as person to be contacted to involve them in our project. The papers where the corresponding author(s) were not affiliated to a European or a Chinese organisation have not been taken into consideration.

#	Affiliation	# of collaborations	Country
1	Department of Clinical Pharmacology, Xiangya Hospital, Central South University, Changsha	115	China
2	Institute of Clinical Pharmacology, Central South University	75	China
3	Engineering Research Center of Applied Technology of Pharmacogenomics, Ministry of Education, Changsha	18	China
4	State Key Laboratory of Oncology in South China	16	China
5	Department of Clinical Physiology and Nuclear Medicine, Turku University Hospital, Turku	14	Finland
6	University of Chinese Academy of Sciences, Beijing	14	China
7	Estonian Genome Center, University of Tartu, Tartu	14	Estonia
8	Institute of Human Genetics, Technische Universität München, Munich	13	Germany
9	Institute of Genomic Medicine, Wenzhou Medical University, Wenzhou	13	China
10	Research Centre of Applied and Preventive Cardiovascular Medicine, University of Turku, Turku	13	Finland

**Table 11. Main Chinese affiliations collaborating with EU on scientific publication**

## 4. Funding Programs Mapping

To complete the mapping between EU and China on PM activities, further analysis have been carried out on funding programmes, by analysing the results ad-hoc surveys implemented in the past by the ERA-PerMed network.

### 4.1 EU Funding Programs - Methodology

The aim of this task is to analyse the mapping of the funding activity in EU..

We started this task by liaising with the IC-PerMed project secretariat as we were aware that a similar job was periodically performed by them – we have therefore decided to not duplicate efforts.

We accessed to the following online database: <https://www.icpermed.eu/app/login>. The database provided an extensive overview of the funding activities in EU through an Excel file where data on funding programs was gathered. The database was organised by information on program, funding organisation, Country and region, budget, number of funded projects, frequency, duration of the programme.

This data was rough for the SINO-EU PerMed objectives, so we proceeded with refining the information collected. Specifically, all organisations' websites and programs have been checked to look for calls that have been published since 2010. This allowed us to collect more precise information on the budget that has been allocated to a certain program or how many projects were funded per program.

The overall data on funding programs has been gathered through simple Excel functions (i.e. “sum”) or by applying excel filters.

Among the 32 organisations involved, there were many for which it was not possible to retrieve information, sometimes due to technical issues (e.g. links were no longer active or it was not possible to find the dedicated sections) and some other times to language barriers. The data that has been found is therefore not homogeneous for all organisations and programs.

Over the past 10 years the overall budget dedicated to projects that are relatable to Personalised Medicine approaches is around 3 Billion €, spread over 3200 projects, for an average funding of 940.000,00 € per project.

The amount of funding has also been quite constant over the years, with no particular peaks or decreases over the analysed decade.

It also emerged that the most active (with a number of programs  $\geq 5$ ) organisations in funding are:

- Germany: BMBF (German Federal Ministry of Education and Research) → 19 programs
- Italy: IT-MoH (Italian Ministry of Health) → 19 programs
- Austria: BMBWF (Federal Ministry of Education Science and Research of Austria) → 14 programs
- France: ANR (Agence Nationale de la Recherche) → 10 programs

- Israel: CSO-MOH (Chief Scientist Office – Ministry of Health) → 8 programs
- Estonia: MSA (Medical Device Database) → 8 programs
- Sweden: Vinnova (Sweden’s Innovation Agency) → 8 programs
- Portugal: FCT (Sciences and Technology Foundation) → 7 programs
- Italy: FRRB (Fondazione Regionale per la Ricerca Biomedica) → 7 programs
- Sweden: SRC (Stockholm Resilience Center → 6 programs
- Ireland: HRB (Health Research Board) → 5 programs
- Denmark: Innofund Denmark (Innovation Fund Denmark) → 5 programs

Further on, the type of beneficiary of the funding has been analysed and what emerged is that these can be split into five main categories: University, University Hospital (Italian IRCCS included), Research Institution, Large Enterprise, Small-Medium Enterprise.

This analysis has been conducted by extrapolating the list of organisations involved. Desk research has been performed to check the organisations’ websites and calls opened over the past years, to see requirements for applications.

Albeit for some organisations it was not possible to retrieve this kind of information, our dataset shows that mostly all of them grant funding to Universities, University Hospitals and Research Institutions, while only few organisations open calls for Large and Small-Medium Enterprises as well.

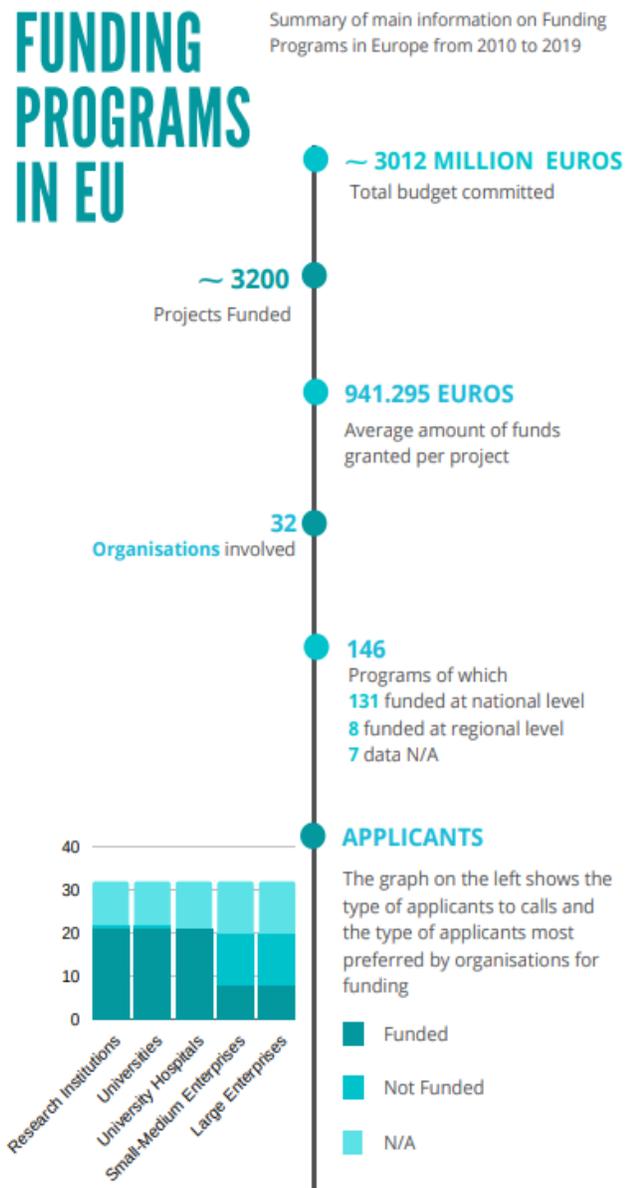


Figure 6. Infographic on Funding Programs in EU

### 4.2 Chinese Funding Programs - Methodology

In order to perform a comparison between EU and CN funding programs, there was the need to collect the same data from China that we had available for EU countries.

Initially it has been decided to adopt the same approach that was used for the European analysis of funding programmes, namely creating an ad-hoc survey to circulate among Chinese funding agencies and retrieve therefore information regarding budget, type of beneficiaries, number of projects funded, duration of the programme, average size of allocated budget frequency of the call for proposal.

In order to collect this information a questionnaire has been devised and shared with our Chinese partners. Such questionnaire can be found as Annex 1 of this document.

Upon suggestion of our Chinese counterparts, the questionnaire has been translated into Chinese, in order to facilitate the responders' understanding and lower the risk of misinterpretations.

The questionnaire has been sent out to a list of stakeholders which have been identified also with the support of IC2PerMed, besides our project partners.

The questionnaire response rate was too low to perform an analysis based on feedback. Furthermore, a feedback on the questionnaire has been received, that PM is may be handled more sensitively in China than we previously thought.

It has therefore been decided to proceed with a desk research through the Chinese National Innovation Funding Programs website (<http://chinainnovationfunding.eu/chinese-national-innovation-funding-programmes/>).

The website contains information on Funding Programs in China, where five funding pillars for science, technology and innovation, coordinated at national level have been identified:

1. **National Natural Science Fund:** basic and applied research in natural sciences
2. **National S&T Major Projects:** major key products, technologies and engineering of strategic importance for China's economy and industrial competitiveness
3. **National Key R&D Programmes:** actively supporting well-defined and well-targeted R&D in areas of social welfare and people's livelihood
4. **The Technology Innovation Guiding Fund(s):** stimulating the transfer and commercialization of key results by investing in innovative start-ups and SMEs through venture capital funds, private equity and risk compensations
5. **The Bases and Talents Programme:** aiming to establish top-notch innovation bases and to foster talents and teams with global competitiveness.

These five pillars of the Chinese national innovation funding programmes have a unified management structure: priorities, strategy, directions and budgeting are coordinated by an inter-ministerial joint council formed by 31 Ministries and government agencies and are led by the Ministry of Science and Technology (MoST).

For the aim of our analysis, we will only shortly summarise the **Chinese National Key R&D Programmes (NKPs)**, which incorporates numerous previously-existing programmes, such as MOST’s “863 Programme” for R&D, “Programme 973” for basic research, Key Technologies R&D Programme, and International S&T Cooperation Programme, as well as NDRC and MIIT’s Industrial Technology R&D Fund.

It supports R&D in areas of social welfare and people’s livelihood, such as agriculture, energy and resources, environment and health. It focuses on key and strategic technologies, featuring several well-targeted and defined objectives and deliverables to be achieved in a period ranging from three to five years and reflecting a top-down industry-university-research cooperation design which integrates basic research, technology application, demonstration and commercialization.

NKPs are currently among the most active and standardized national funding programmes in China, with a total of 65 NKPs established to date, each of them funding numerous projects in different areas every year. Since their official launch, a total of 6.57 billion EUR have been allocated by the central government for 42 NKPs in 2016 and 2017.

In Figure 7 we can see that around 1.25 million EUR have been specifically dedicated to Precision Medicine in 2016 and 2017. <http://chinainnovationfunding.eu/national-key-rd-programmes/>

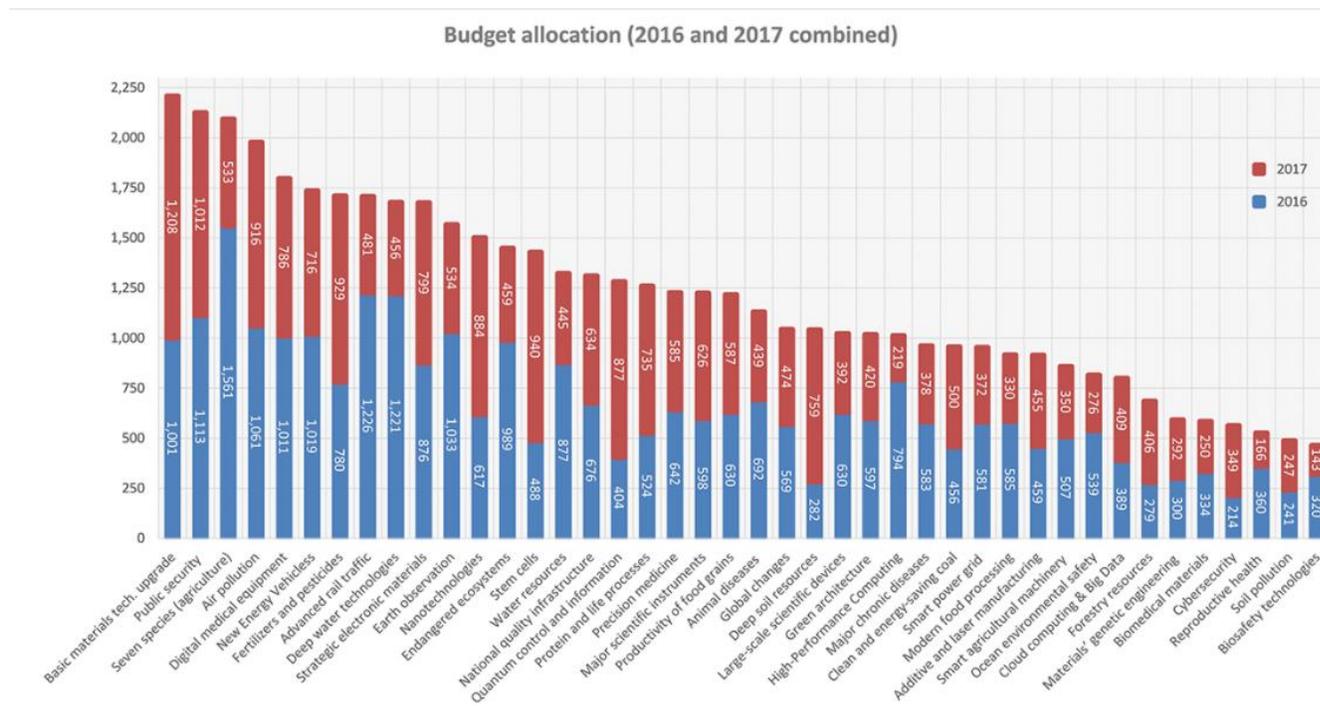


Figure 7. Overall budget allocation on NKPs in 2016 and 2017

The key requirement to participate can be divided into two main categories:

1. **General requirements:** applicants to have been legally registered in China for a minimum duration of around 1 year; age-related requirements for proposed PIs or sub-topic coordinators; limitations on the maximum number of central S&T funding projects simultaneously implementable by PIs or other team members (generally no more than one or two national-level projects at the same time); and instructions regarding which government agency the applicant should obtain official endorsement from. \* If the proposed PI is a foreign national (including from Hong Kong, Taiwan, and Macau), then relevant employment certificates should be provided (by the Chinese employer if the PI is employed full-time in China, or by both the Chinese and foreign employer if not employed full-time in China). Central and local governmental agencies, government officials, and experts who have drafted the tenders are automatically non-eligible.
2. **Additional requirements** specified in the project guidelines for specific NKPs: Additional requirements might also be required for specific National Key R&D Programmes, depending on their field, directions (e.g. research- or commercialisation-oriented), or activities (e.g. experiments involving certain resources such as pathogens, animals, etc.). The most recurrent generally are the requirement for the project consortium to provide additional funds according to certain proportions specified in the tender (usually ranging from 1:1 to 4:1 in correlation with funds to be provided by the central government); encouragement of “industry-university-research” joint applications; obligation to promote the conversion and application of results generated under the project; mandatory or legally-binding data-sharing with MOST. Some calls also encourage, like in Europe, young scientists to participate or lead the projects as PIs

### International Participation

Even though the legal framework of NKPs explicitly encourages the participation of international actors and experts in both the preparatory and implementation stages of the projects, in reality the situation seems to not meet these expectations.

From an analysis of the 2016 and 2017 annual tender cycles, it emerged that:

- Only (0.9%) NKPs assigned were led by international entities
- Only 2 out of 2,288 National Key R&D Programmes assigned were led by a foreign PI
- Very few foreign experts sat in evaluation committees (all being ethnic Chinese foreign nationals, or Hong Kong / Macao / Taiwan citizens)
- No evidence of foreign experts among the expert committees drafting tender guidelines
- No figures on international participation in wider project consortiums are available, but is expected that these should be higher.

### Conclusions

The research for PM-related funding programs in China has proven to be more challenging than initially thought.

We have identified the Chinese stakeholders with the support of our Chinese partners and of ICPeMed Secretariat, but the only feedback received from them was that the lack of response might be indicative of a confidential approach towards Personalised Medicine in China and is therefore handled in a more sensitive manner.

## Annex 1 – Questionnaire\_ENG

### Questionnaire to collect data of ongoing National/Regional Funding Programmes related to Personalised Medicine

#### Aim and Target group of the questionnaire:

Sino-EU PerMed is funded by Horizon 2020, the EU's Framework Programme for Research and Innovation, with the aim to strengthen the collaboration between Europe and China in the field Personalised Medicine Research and Innovation. It has been launched in January 2020 and represents a unique bi-regional consortium of 6 partners from governmental, funding and research organisations from Europe and China

This questionnaire is part of the mapping and is addressed to Chinese organisation specialised in funding research and innovation in Health Research . To help you navigate through the questionnaire we have prepared a list of key definitions.

#### List of Definitions:

**Funding Agency:** A Funding Agency is any organization, public or private, which provides funds for a particular purpose. In this survey we are focused on funds provided to finance Health Research

- **Funding Programme:** A funding programme is a periodic (usually multiannual) framework that commits a specific amount of money to support the achievement of a goal or a policy. In the context of this survey we intend funding programmes dedicated to Research and Innovation in the health sector
- **Research Project:** A project is a **temporary** endeavor undertaken to create a **unique** product, service or result. In the context of this survey we search for Research and Innovation projects which have an impact in the health sector.
- **Call for Proposal:** A call for proposals is a thematic and financial frame that indicates which problem should be tackled and which budget is available to meet this challenge. All of the thematic, financial and administrative conditions (also called eligibility criteria) of a call for proposals are usually laid down in a call for proposals. Organisations that intend to help solve a part of this problem, can submit a project proposal during the period that the call for proposals is open.
- **Transnational projects:** In transnational projects, actors from the private and public sectors, universities and civil society organisations across countries (in Europe at least three) work closely together to advance new or improved solutions delivered to meet pressing needs of their population (also called societal challenges)
- **Personalised Medicine:** a medical approach using characterization of individuals' phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) for tailoring the right therapeutic strategy for the right person at the right time, and/or to determine the predisposition to disease and/or to deliver timely and targeted prevention. Personalized medicine is focused on **i)** personalised treatment strategies, in this meaning “treatments targeted to the needs of individual patients on the basis of genetic, biomarker, phenotypic or psychosocial characteristics that distinguish a given patient from other patients with similar clinical presentations”; **ii)** personalised diagnosis by using more clinical data, in this meaning a model that integrates clinical and other data to stratify patients into novel subgroups”; **iii)** patient-specific prevention strategy, in this meaning the application of clinical know-how, concepts of systems medicine, and personalised medicine technologies to improve health and minimize disease risk.

**Your Organisation (administrative information)**

**1. Please fill out your organisation profile**

Name of your organisation (full name)	
Name of your organisation (short name)	
Type of Funding agency ( Ministry, Foundation, Charity, Non-for profit Associations, other: specify)	
Website	
Contact person for this questionnaire	
Position	
Email address	
Phone	
Postal address	
Country	
Region	

**Your Organisation (funding information)**

*Note: If no exact budget/number can be provided, please give a rough estimate.*

**2. What was the overall budget of your organisation for research project funding in 2018 (Million of RMB)?**

In Medicine and Health	
Specifically in Personalised Medicine	

**3. What was the overall budget of your organisation for research project funding in 2019 (Million of RMB)?**

In Medicine and Health	
Specifically in Personalised Medicine	

**4. Please provide an estimate of the number of research projects granted in 2018.**

In Medicine and Health	
Specifically in Personalised Medicine	

**5. Please provide an estimate of the number of research projects granted in 2019.**

In Medicine and Health	
Specifically in Personalised Medicine	



**6. At which level does your institution finance research projects related to Personalised Medicine (see definition above) Check any that apply**

- Regional
- National
- /transnational
- No grants/ subsidies
- Others

Please Specify:

**6.1. If yes for *transnational* level, please specify the main geographical areas you cooperate with: Check any that apply**

- Asia
- Europe
- United States
- Canada
- Other

Please specify name of country/geographical area, year, edition. Etc.

**7. What kind of research entity can be funded by your organisation?**

**Check any that apply**

- Public (Academia, Hospitals, Research Institutions)
- Industry (for profit organisations, enterprises)
- Non-for profit organisations
- Other

Please specify:

**8. What kind of research can be funded by your organisation?**

**Check any that apply**

- All
- Preclinical
- Translational
- Applied
- Industrial
- Clinical
- Other

Please Specify:

## Annex 2 – Questionnaire\_Translated in Chinese

### 收集有关正在进行的个性化医疗国家/地区赞助计划的问卷

#### 问卷的目的和目标群体：

Sino-EU PerMed 由欧盟研究与创新框架计划 Horizon 2020 赞助，目标是加强中国和欧洲在个性化医疗研究与创新领域的合作。本项目于 2020 年 1 月启动，是经中国和欧洲六家政府组织、赞助机构和研究机构跨地区共同努力，携手打造的特色项目。

本问卷是项目规划的一部分，供中国专门从事 Health Research 研究和创新赞助工作的机构填写。为了方便您浏览问卷，我们为您准备了一份关键术语列表。

#### 术语定义列表：

**赞助机构：**赞助机构是指为特定的目的提供资金的任何公立或私营组织。在本次调查中，我们主要指的是赞助 Health Research 的资金。

- **赞助计划：**赞助计划是指在一定时期内（通常是几年）提供一定数量的资金来支持目标实现或政策实施的框架。在本次调查中，主要是指专门用于卫生领域研究和创新的赞助计划。
- **研究项目：**项目是指用于创建**唯一**产品、服务或结果的**临时**工作。在本次调查中，我们寻找的是对卫生领域有影响的研究与创新项目。
- **提案：**提案是指主题框架和财务框架，指明了应解决的问题以及能用于解决问题的预算。提案的所有主题条件、财务条件和管理条件（也称为“合格标准”）通常都应在提案中列出。参与解决问题的机构应在提案公开期间提交项目计划书。
- **跨国项目：**在跨国项目中，来自各个国家（对于欧洲，至少为三个国家）民营企业和国有企业、大学和民间组织的工作人员密切合作，提出新的解决方案或对已有的解决方案加以改进，以应对国家当前面临的紧迫问题（也称为“社会挑战”）。
- **个性化医疗：**是指利用个人的表现型和基因型特征（例如分子谱、医学成像和有关生活方式的数据），在适当的时间为适当的个人量身定制适当的治疗策略，和/或确定对某些疾病的易感性和/或进行及时和有针对性的干预。个性化医疗主要关注于：**i)** 个性化治疗策略，即“根据患者的基因、生物标志物、将患者与其他有类似临床症状的患者区分开来的表现型或心理特征进行能满足患者需求的针对性治疗”；**ii)** 通过更多的临床数据进行个性化诊断，即整合临床数据和其他数据将患者细分为新的子组别的模型；**iii)** 针对性的患者干预策略，即应用专业临床知识、系统医疗概念和个性化的医疗技术来改善健康状况，并将患病风险最小化。

## 您所在的组织（管理信息）

### 1. 请填写您所在的组织的资料

您所在组织的名称（全称）	
您所在组织的名称（简称）	
赞助机构的类型（政府部门、基金会、慈善机构、非营利性协会或其他（请指明））	
网站	
用于本问卷的联系人	
职位	
电子邮件	
电话	
邮寄地址	
国家	
地区	

## 您所在的组织（赞助信息）

*请注意：如果无法提供精确的预算/金额，请提供大概预算/金额。*

### 2. 您所在的组织 2018 年用于赞助研究项目的总预算是多少（以百万人民币为单位）？

用于医疗与卫生	
专门用于个性化医疗	

### 3. 您所在的组织 2019 年用于赞助研究项目的总预算是多少（以百万人民币为单位）？

用于医疗与卫生	
专门用于个性化医疗	

### 4. 请提供 2018 年批准的研究项目数量（估算）。

用于医疗与卫生	
专门用于个性化医疗	

### 5. 请提供 2019 年批准的研究项目数量（估算）。

用于医疗与卫生	
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专门用于个性化医疗

6.您所在机构对什么层面的个性化医疗相关的研究项目进行赞助（请参考上文的定义）？请勾选所有适用项。

- 地区层面
- 国家层面
- /跨国层面
- 无补助/无津贴
- 其他

请指明：

6.1.如果您勾选的是*跨国层面*的赞助，请指明您所在机构主要合作的区域：

请勾选所有适用项

- 亚洲
- 欧洲
- 美国
- 加拿大
- 其他

请指明国家/地区的名称、年份和版本。等等。

7.哪些研究实体能得到您所在机构的赞助？

请勾选所有适用项

- 公立（学术机构、医院、研究机构）
- 工业（营利机构、企业）
- 非营利机构
- 其他

请指明：

8.哪些研究能得到您所在机构的赞助？

请勾选所有适用项

- 所有研究
- 临床前期研究
- 转化研究
- 应用研究
- 工业研究
- 临床研究
- 其他

请指明：