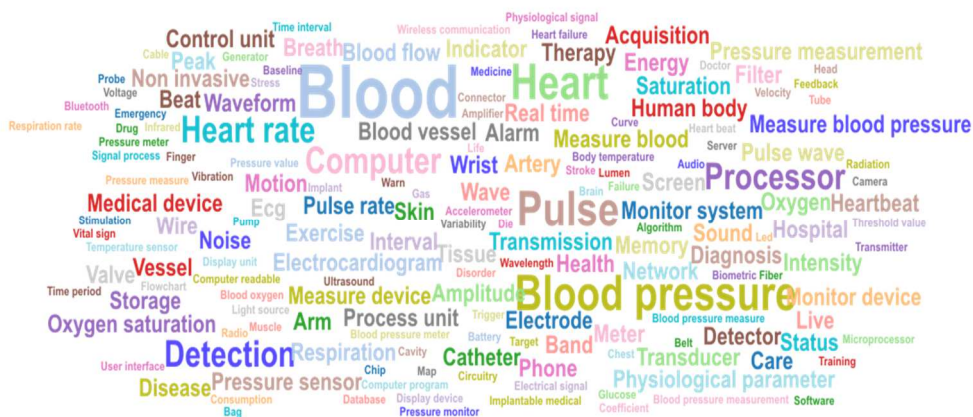


Patent data analysis and mapping

May 2017

Corinne Borredon
Carole Pesenti



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INTRODUCTION

Continual innovation in the health industry has led to significant medical advances and transformed medical practices, in particular through the use of digital technology.

Today, new technology in the health sector is not just based on biology, chemistry, physics, or even electronics; recently, we have also seen the rise of the information and communication technology (ICT) field. The inventions in question are protected by a number of patents worldwide.

Among the five¹ main health industry sectors, the global medical devices market is experiencing sustained growth. Before writing this study, we carried out a prospective analysis (see Appendix 1) of data relating to patents across the entire medical devices sector. Our initial searches in global patent databases allowed us to establish that **the cardiovascular diagnostic devices segment was particularly innovative** compared with other forms of medical technology.

Cardiovascular diseases (CVDs) are the number one cause of death worldwide and account for 31% of all global deaths². 75% of deaths caused by CVDs occur in low- and middle-income countries³. The main risk factors of CVDs are hypercholesterolemia, hypertension, diabetes, being overweight and tobacco use. Some of these factors can be detected and monitored thanks to medical diagnostic devices.

The aim of this study is to analyse a large volume of data relating to patents solely concerning “cardiovascular diagnostic devices”.

The methodology and databases used are outlined in Appendix 2 and a list of acronyms and definitions is provided in Appendix 3.

Part 1 is dedicated to providing an overview of economic data available to the public in order to better understand the challenges facing the global medical devices market and, more specifically, the cardiovascular diagnostic devices market.

Parts 2 and 3 focus on analysing published patent applications and provide information highlighting the main players in the industry, the different technology, and the temporal and geographic distribution of inventions, both in France and abroad. In addition, mapping is used to identify and group related technology, to position players and the countries of origin of the inventions, and to compare their respective development.

¹The health industry has 5 main sectors: pharmaceutical products, biotechnology/biopharmacy, medical devices, information and communication technology for eHealth and food supplements. Source: “[Rapport PIPAME 2011](#)”, p. 11 (Report issued by the French Inter-ministerial Centre for Forecasting and Anticipating Economic Change, available in French).

² World Health Organization (WHO), January 2015 – <http://www.who.int/mediacentre/factsheets/fs317/en/>

³ <http://www.world-heart-federation.org/cardiovascular-health/global-facts-map/>

OVERVIEW OF THE STUDY

In 2015, the global medical devices market was estimated at \$200 billion⁴, with annual growth of 4 to 5% according to industry sources.

The cardiovascular diagnostic devices segment of this market is experiencing even higher growth. A more in-depth study of the cardiovascular monitoring and diagnostic devices segment shows that it was worth almost \$2 billion in 2015.

The economic data presented in Part 1 of this study indicate an increase in the medical devices market by 2020, with significant growth expected in the area of cardiovascular diagnostic devices.

This study draws on a large volume of data relating to patents⁵ concerning cardiovascular diagnostic devices with the aim of identifying, analysing and visualising changes in market players and technologies, both worldwide and in France.

It covers a period of 15 years (patents filed between 01/07/1999 and 30/06/2014) and includes 27,552 inventions from 59 patent offices.

We have identified nine key technological areas and applications which use these patents: implantable devices, blood pressure monitors and pulse and heart rate measurement, biometric activities, monitoring and data transmission, catheters, physiological data, image processing, blood flow detection and measurement techniques.

On a global scale, the number of patents filed tripled between 2000 and 2013, and the number of patent applications filed has increased rapidly since 2009. Between 2012 and 2013, growth reached 11%, compared with just 9% for all types of technology. The global cardiovascular device market is clearly particularly buoyant. Modern technology is shifting towards eHealth and the transmission of diagnostics data in digital format.

With respect to first filings, the three main countries are the United States, China and Japan.

Patent filings are steadily on the rise in the United States and protection is more often sought internationally (51%). The target market of companies that file patents in the United States is the biggest market worldwide. The inventions concerned span all areas and are highest in the areas of implantable devices and catheters.

Patent filings in Japan were stable over the period studied and protection was sought internationally in 38% of cases. More specifically, they concern biometric activities, measurement techniques, pulse and heart rate measurement, and blood pressure monitors.

In China, patent filings have risen sharply since 2008 but protection was sought internationally in only 4% of cases. Almost half of Chinese applications are for utility models⁶. The technology covered by these patents mainly concerns monitoring and data transmission, as well as pulse and heart rate measurement and blood pressure monitors, and is concentrated on the Chinese market.

⁴ <http://www.businesscoot.com/le-march-des-dispositifs-m-dicaux-1000/> (in French)

⁵ Only patent data have been used in this study. It should be noted that in this area, some players publish articles without necessarily filing a patent.

⁶ Utility model patents, also known as “petty patents”, are traditionally used in China as they are quick and easy to obtain. They are relatively cheap compared to standard patents.

The three main cardiovascular diagnostic device companies innovate in different technological areas.

US company MEDTRONIC, the leader on the medical device market and pacemaker specialist, mainly sells implantable devices (pacemakers) and catheters. The company's highest number of filings was recorded in 2004. Its research and development activity is solely based in the United States. Its second target market is Europe. The company rarely works with third parties and does not outsource its R&D activities. We have noted that the number of patent applications made by the company has decreased slightly since 2012. However, it has developed its acquisition strategy by buying out COVIDIEN, the leader on the medical device market and pacemaker specialist, mainly sells implantable.

Having initially been present in the areas of image processing, monitoring and data transmission, Dutch giant PHILIPS has extended its offering to cover all diagnostic devices. It is now the leader in prevention, diagnosis and treatment of cardiovascular disease. The company's highest number of filings was recorded in 2012. Its research and development activity is based in Europe and the United States, and its third target market is Asia. PHILIPS stands out from the other two main applicants due to its extensive international protection policy. The company rarely works with third parties and does not outsource its R&D activities.

Japanese company OMRON HEALTHCARE, the leader on the blood pressure monitor market, mainly focuses on the areas of pulse and heart rate measurement and, in particular, blood pressure monitors. The company's highest number of filings was recorded in 2008. Its research and development activity is mainly based in Japan. Its second market is the United States, followed by China. The company rarely works with third parties and does not outsource its R&D activities.

France is ranked eleventh among countries of first filing. The inventions are evenly spread out across the nine main application areas.

The leading company in France in terms of patent filings is SORIN CRM, the French subsidiary of the Italian group SORIN (world leader in cardiovascular medical devices). Among the 20 main patent applicants, 9 are French public research bodies.

Lastly, there is a considerable partnership network between both universities, schools and regional hospitals, and between companies and French public research bodies. State-funded research is very present in this area.

Three emerging companies have been identified following their patent applications between 2011 and 2013:

- WITHINGS, a start-up specialising in connected objects for health and well-being, which has just been acquired by Finnish giant NOKIA;
- OLEA MEDICAL, which operates in the area of medical imaging software and was bought out in 2015 by Japanese company TOSHIBA;
- BODYSENS, a start-up focused on developing communicating physiological sensors which collect the wearer's health data and send them to be analysed remotely. The company changed its name to APPI-Technology in 2016.

It should be noted that most of the French start-ups identified have been bought out by foreign groups over the past few years.

This study provides examples of several inventions.

Data at 13/06/2016	CARDIOVASCULAR DIAGNOSTIC DEVICES
Number of published patent applications	84,618
Number of patent families	27,552
Period studied: 15 years of patent applications	01/07/1999 to 30/06/2014
Number of patent offices of first filing	59
Record number of patents filed	2013
Main patent applicants worldwide and number of patent families	MEDTRONIC (US) 539 PHILIPS (NL) 513 OMRON HEALTHCARE (JP) 509
Main offices of first filing ⁷ and number of patent families	USPTO 11,103 SIPO 4,862 JPO 4,746 KIPO 1,189 DPMA 1,133 INPI 194 (11 th position)
Main patent applicants in France and number of patent families	SORIN CRM 19 UNIV GRENOBLE FOURIER 10 CNRS 9

Source: Clarivate Analytics – Data processing by INPI (2016)

⁷ <http://www.wipo.int/directory/en/urls.jsp>

1. ECONOMIC DATA: MARKETS AND PLAYERS

1.1 MARKETS: ANALYSIS AND TRENDS

The global medical devices market is experiencing continued growth.

In 2015, the global medical devices market was estimated at \$200 billion (\$bn)⁸.

With annual global growth projected at over 4% for the coming years⁹, this market should reach \$477 billion by 2020.

In 2015, between 800,000 and 2 million medical devices were available on the market in France, representing annual revenue of roughly €20 billion.

Positioning of France: around 1,100 French companies are present on the medical devices market¹⁰. More than 9 out of 10 companies employ less than 250 people. France ranks 9th in terms of exports, with a 4% share of the global export market.

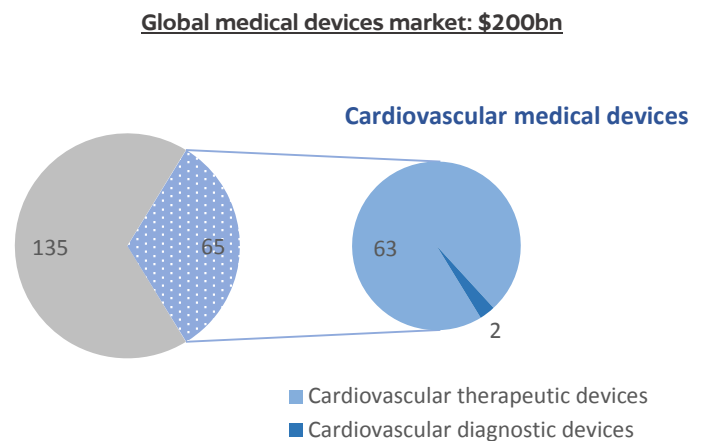
The cardiovascular diagnostic devices market is experiencing even higher growth.

In 2015, the CVD market represented \$65 billion¹¹, or one third of the entire medical devices market (Figure 1) and could be broken down as follows in 2014: 43% in the United States, 22% in Europe and 16% in Japan.

A more in-depth study of the cardiovascular monitoring and diagnostic devices market segment shows that it was worth almost \$2 billion in 2015 (shown in dark blue in Figure 1). Today, this market segment only represents a very low percentage of the global medical devices market (<1%).

With an annual growth rate of 6.4%, this market should reach almost \$3.1 billion by 2024 and may even experience higher growth in certain geographic areas (such as the Asia-Pacific and Latin America regions)¹².

Figure 1: Breakdown of the medical devices industry by market share



Sources: 2015 data derived from the various sources referred to in this section. The cardiovascular medical devices market covers both diagnostic and therapeutic devices.

⁸ <http://www.businesscoot.com/le-march-des-dispositifs-m-dicaux-1000/> (in French)

⁹ EvaluateMedTech Report, Oct. 2015: <http://info.evaluategroup.com/rs/607-YGS-364/images/mtwp15.pdf>

¹⁰ Sources: PIPAME 2011 and SNITEM Annual Report 2015 (both in French) <http://www.snitem.fr/rapport-annuel-2015>.

¹¹ <http://www.grandviewresearch.com/industry-analysis/cardiovascular-devices-market>

¹² The Asia-Pacific and Latin America regions are expected to grow by 7.5% and 7.3% respectively over the period in question;

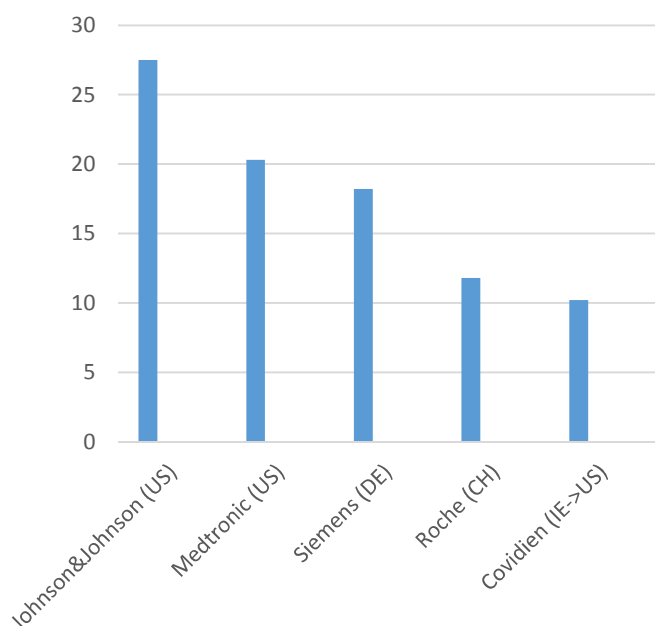
<https://www.mordorintelligence.com/industry-reports/global-cardiovascular-devices-market-industry?gclid=CMiW2duy4tACFVRAGwodnPCpMA>

1.2 THE MAIN PLAYERS

The main players on the medical devices market today can be clearly identified.

In 2014, on an annual global market estimated at approximately \$200 billion, the top five medical devices companies were JOHNSON & JOHNSON (US, \$27.5bn), MEDTRONIC (US, \$20.3bn), SIEMENS (Germany, \$18.2bn), ROCHE (Switzerland, \$11.8bn) and COVIDIEN¹³ (Ireland, \$10.2bn). The highest-ranking French company was ESSILOR INTERNATIONAL in 16th place with revenue of \$6.6 billion. The company specialises in optical medical devices and visual health solutions.

Figure 2: Main global players on the medical devices market
(Revenue in \$bn, 2014)



Source: rapport EvaluateMedTech¹⁴

According to the EvaluateMedTech¹⁴ report, MEDTRONIC should take the lead on the global market by 2020 thanks to its advanced acquisition strategy and its ambitious research and development policy. This strategy saw MEDTRONIC acquire Irish company COVIDIEN in 2015 for \$42.9 billion. COVIDIEN is the fifth-largest company in the medical devices sector. This acquisition had not yet been taken into account in the patent data analysed in this study. The two companies are therefore dealt with separately.

The main players in the cardiovascular diagnostic devices segment are not identified. This prompts us to ask a series of questions.

Who are the key innovative players in this market segment? Have these heavily invested in R&D over the past few years? Are some of these players positioned on a target market and do they specialise in one or several types of technology? What are the main technological trends?

Are the main players identified above also present in the promising cardiovascular diagnostic devices segment?

There is currently no freely accessible information on the main players in this segment.

The following parts focus on patent analysis and aim to provide information so as to identify the main players and the main types of technology in the cardiovascular diagnostic devices segment.

¹³ COVIDIEN was acquired by MEDTRONIC in 2015: <http://newsroom.medtronic.com/phoenix.zhtml?c=251324&p=irol-newsArticle&ID=2010595>

¹⁴ <http://www.evaluategroup.com/public/EvaluateMedTech-Overview.aspx>

2. PATENT ANALYSIS ON A GLOBAL LEVEL: 27,552 INVENTIONS OVER A PERIOD OF 15 YEARS

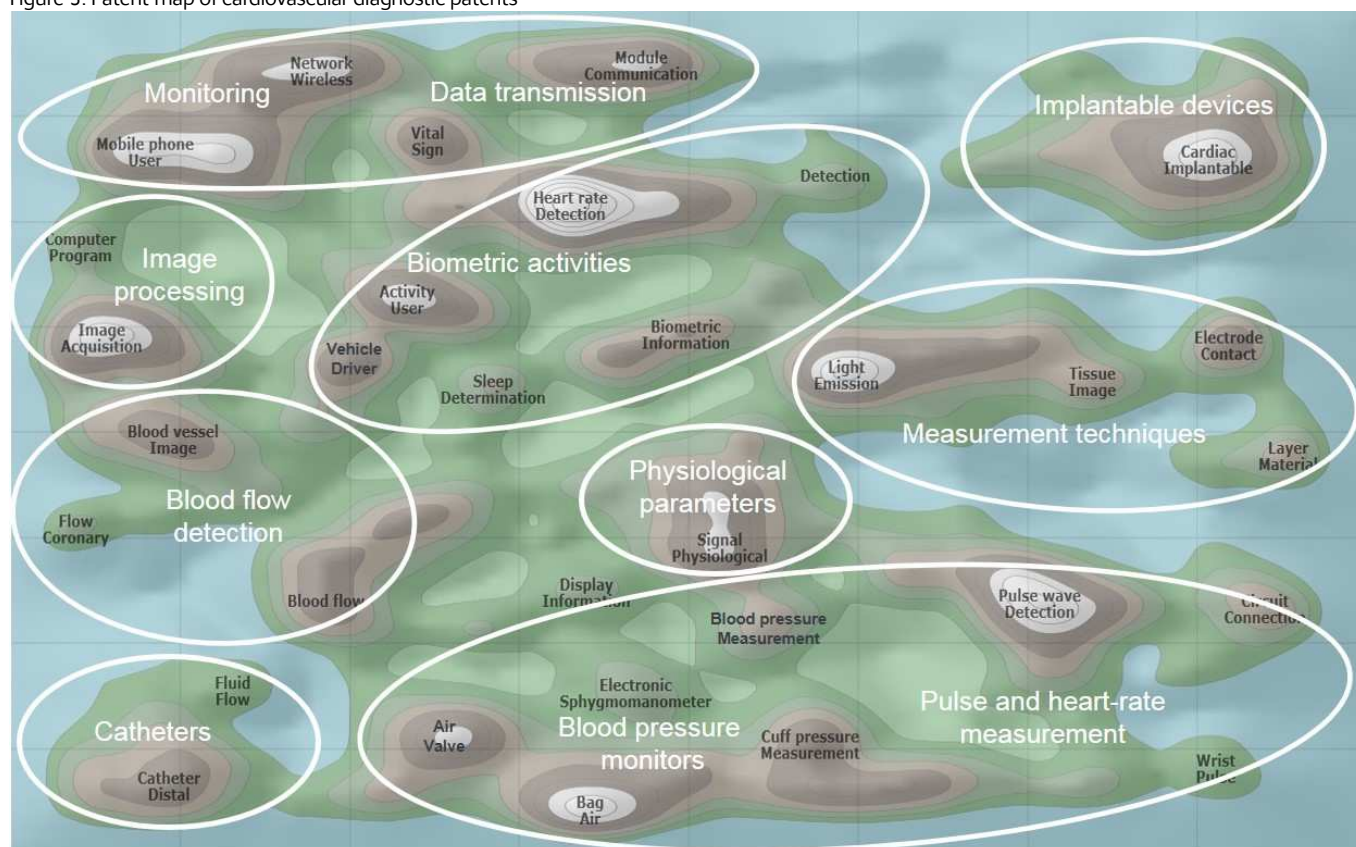
2.1 WHAT KIND OF TECHNOLOGY IS BEING DEVELOPED IN THE CARDIOVASCULAR DIAGNOSTIC DEVICES SECTOR?

Cardiovascular diagnostic devices cover nine key fields of technology.

CVDs are a group of disorders of the heart and blood vessels. They include: coronary heart disease, cerebrovascular disease, rheumatic heart disease and a number of other disorders. Cardiovascular diagnostic devices cover a wide range of technology.

Based on the semantic analysis of the content of titles and abstracts, patent mapping¹⁵ makes it possible to identify different technology and applications in a given sector. Inventions with similar content are placed close to one another. The topographic curves indicate the concentration of patents, which is also judged by the colour. The white peaks and mountains indicate the highest concentration of patents. Recurring terms are shown on the maps.

Figure 3: Patent map of cardiovascular diagnostic patents



Source: Clarivate Analytics - Data processing by INPI (2016)

¹⁵ Methodology provided in Appendix 2.

The patent map of cardiovascular diagnostic devices highlights nine key fields of technology and applications, which are represented by circles in Figure 3:

- “implantable devices” including for example cardiac implants and pacemakers;
- “blood pressure monitors and pulse and heart-rate measurement” including devices for monitoring blood pressure and the heart rate;
- “biometric activities” including devices designed to gather data from the user (e.g. data on sleeping patterns, physical activities);
- “monitoring and data transmission” including technology linked to monitoring and the digital transmission of data relating to the patient;
- “catheters” including medical devices to introduce fluid into the body or remove fluid from the body;
- “physiological parameters” including devices to acquire and analyse physiological data of a patient;
- “image processing” including imaging and visualisation devices for the cardiovascular system;
- “blood flow detection” including devices for evaluating or examining blood vessels;
- “measurement techniques” including, for example, electrodes for electrocardiograms, devices that use optical or acoustic measurements, and measurement materials or components.

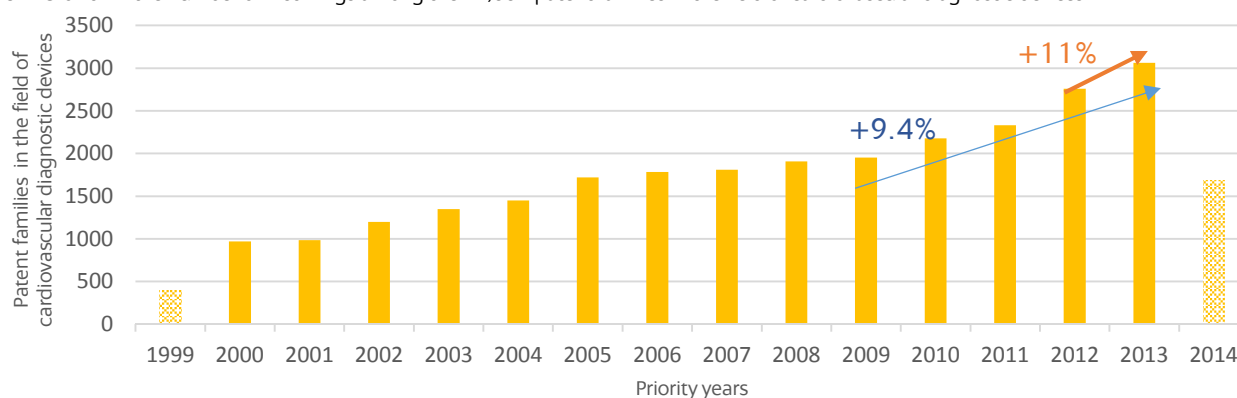
2.2 HOW ARE PATENT FILINGS CHANGING OVER TIME?

Patent applications in the field of cardiovascular diagnostic devices are constantly on the rise with a higher growth rate than other fields of technology.

Since 2009, the number of patent applications has risen sharply (Figure 4) and the projected data for 2014 confirmed this trend.

The number of patents filed tripled between 2000 and 2013, and over the last five full years of filing (2009 to 2013), the average growth rate was 9.4%.

Figure 4: Growth in the number of first filings among the 27,552 patent families in the field of cardiovascular diagnostic devices



Source: Clarivate Analytics - Data processing by INPI using Intellixir software (2016) - The first priority years 1999 and 2014 are shaded as the data were incomplete.

If we look at the figures for 2012 and 2013 alone, we can see that global patent filings for cardiovascular diagnostic devices rose by 11% year-on-year in 2013, compared to a global increase of just 9% year-on-year for all types of technology¹⁶. The global cardiovascular device market is particularly buoyant.

¹⁶ World Intellectual Property Indicators 2014 report published by the World Intellectual Property Organization (WIPO)
http://www.wipo.int/pressroom/en/articles/2014/article_0018.html

Modern technology is shifting towards eHealth and the transmission of diagnostics data in digital format.

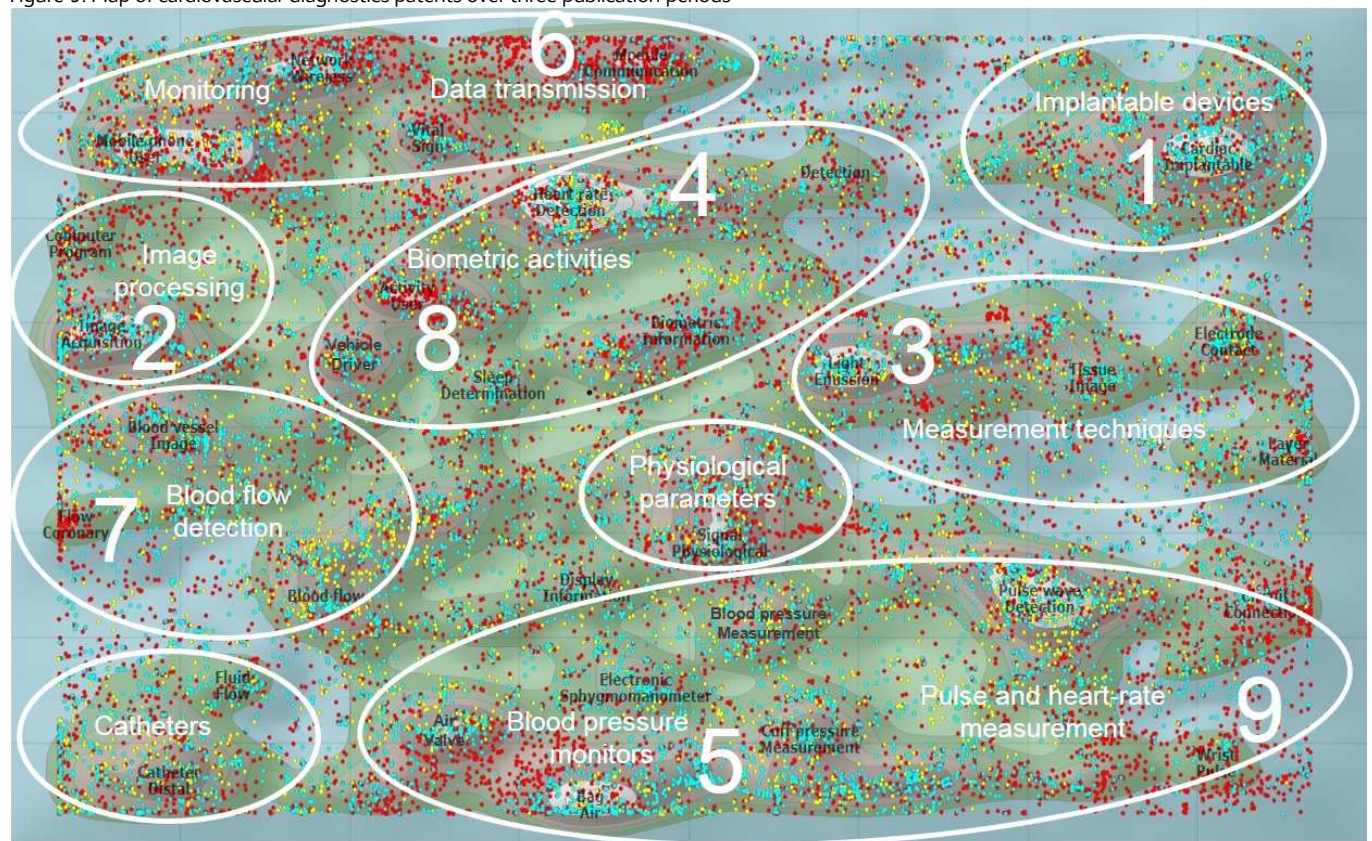
The use of visualisation techniques for patent publication data makes it possible to carry out a more in-depth analysis by technological sub-field.

The map below was created using publication data over a 15-year period, from 2001 to 2015. These publication periods cover the filing dates we examined, as patent applications are published roughly 18 months after the first priority date.

This 15-year publication period was broken down into three periods of five years each, enabling us to identify the fields in which technology advanced the most, and to highlight the momentum in the field of cardiovascular diagnostics.

The number of patent families¹⁷ doubled between the first and second periods (2001-2005 and 2006-2010) and tripled between the first period (2001-2005) and the last period (2011-2015).

Figure 5: Map of cardiovascular diagnostics patents over three publication periods



Source: Clarivate Analytics - Data processing by INPI (2016)

- 2001-2005 period: 4,790 patent families
- 2006-2010 period: 8,930 patent families
- 2011-2015 period: 13,558 patent families

¹⁷ The methodology used is outlined in Appendix 2.

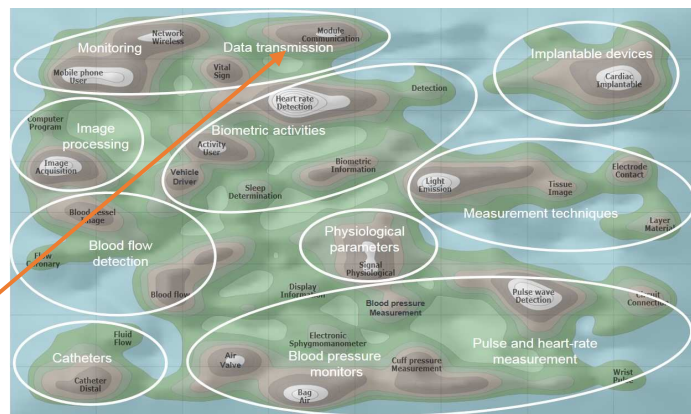
The high-density areas for the three publication periods are represented by a concentration of coloured dots.

- Looking at the first period (**2001-2005**), the dots are spread out fairly evenly and there does not seem to be a peak in a particular type of technology.
- The technology subject to patent applications in the second period (**2006-2010**), appears to be concentrated in the following fields of technology:
 - “**cardiac implantable devices ①**” under **implantable devices**,
 - “**image acquisition ②**” under **image processing**,
 - “**light emission ③**” under **measurement techniques**,
 - and certain areas of **biometric activities ④** and **blood pressure monitors ⑤**.
- During the third period (**2011-2015**), innovation was particularly high in the area of **monitoring and data transmission** (see example 1 below). New inventions also appeared in the following fields of technology:
 - “**communication modules ⑥**” under **data transmission**,
 - “**coronary flow ⑦**” under **blood flow detection** (see example 2 below),
 - “**user activity ⑧**” under **biometric activities** (see example 3 below),
 - and “**wrist pulse ⑨**” under **pulse and heart-rate measurement** (see example 4 below).

These technological sub-fields were completely absent during the first period (**2001-2005**).

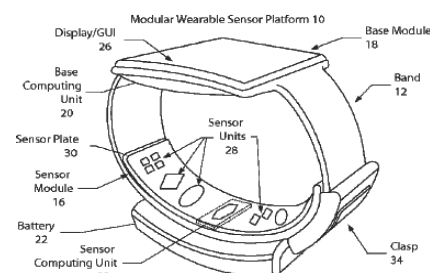
The following examples¹⁸ of patents illustrate the thriving fields described above.

SAMSUNG (KR), which is famous for its LCD screens, televisions and mobile phones, is continuing to develop its connected wristband activity, through inventions in the area of monitoring and data transmission (“communication modules”), such as eHealth and cardiovascular diagnostic applications.

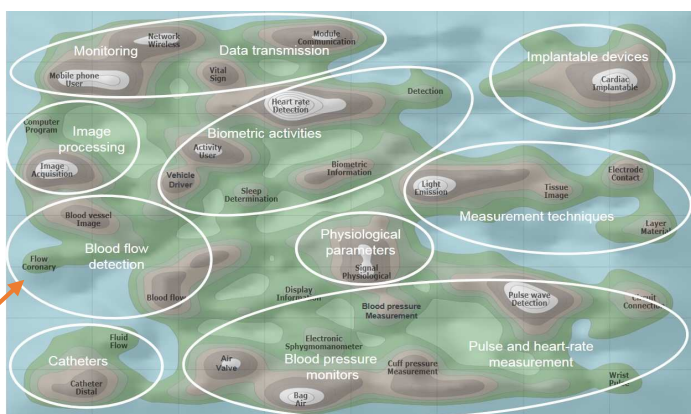


Example 1:

Patent application No. WO2015177649, filed by **SAMSUNG (KR)** and published in 2015, describes an adjustable system worn about a body part of the user to measure one or more physiological characteristics and optimises the proper positioning of the sensors for monitoring and data transmission.

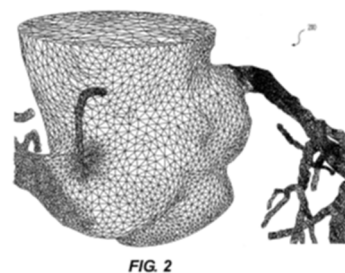


Some areas also show a high concentration of patents, such as the blood flow detection area (“coronary flow”), with US company **HEARTFLOW**¹⁹ filing almost all of its patents in this area²⁰. Created in 2007 and specialised in the development of non-invasive medical technology in the cardiovascular field, the company designs personalised 3D models of coronary arteries. Since 2017, it has been working alongside SIEMENS HEALTHINEERS²¹ to continue developing its solutions using Siemens’ expertise in imaging.



Example 2:

Patent application No. WO2015030998, filed by **HEARTFLOW (US)** and published in 2015, describes systems and methods for predicting the location, onset, or change of coronary lesions from factors like vessel geometry, physiology, and hemodynamics.



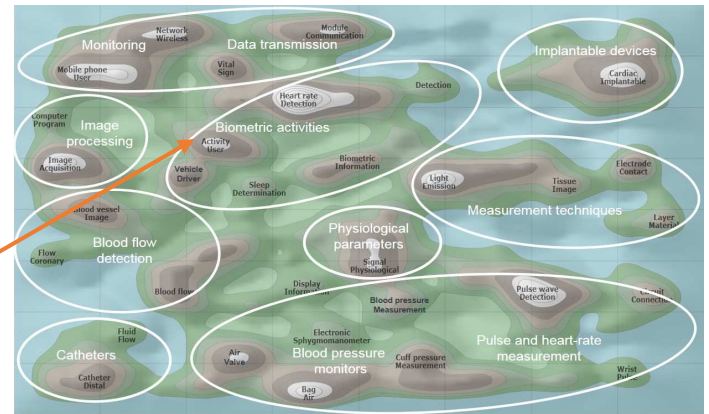
¹⁸ The examples presented in this study concern recent patent publications and are currently pending with patent offices, unless otherwise specified.

¹⁹ <https://www.corporationwiki.com/California/Redwood-City/heartflow-inc/44836218.aspx>

²⁰ 87 patent families out of 98.

²¹ [http://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2017/healthineers/pr2017030233hcn.htm&content\[\]=HC](http://www.siemens.com/press/en/pressrelease/?press=/en/pressrelease/2017/healthineers/pr2017030233hcn.htm&content[]=HC)

Inventions relating to diagnostic devices in the field of biometric activity are also thriving. For example, US company **FITBIT**²² is extremely present²³ in the **area of biometric activities** (“user activity”). Created in 2008, it develops and sells activity tracking devices and other connected objects, and has seen a surge in growth thanks to its innovations.



Example 3:

Patent No. US9039614, granted to **FITBIT (US)** in 2015, describes methods and devices in the form of a housing or wristband used to measure the heart rate for everyday activity tracking applications.

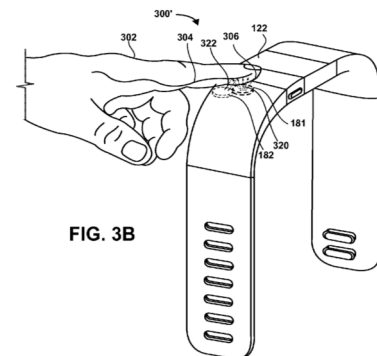
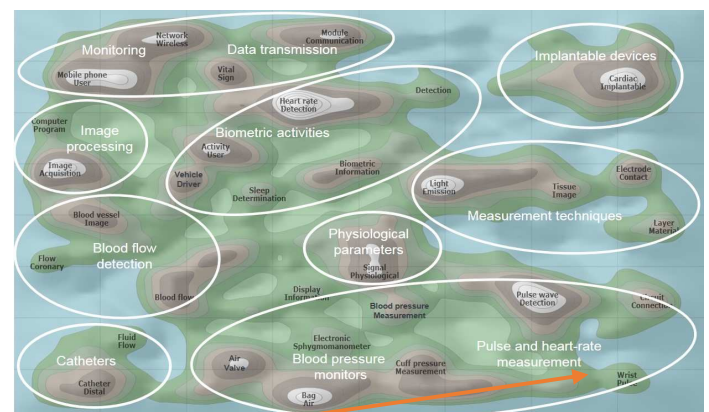


FIG. 3B

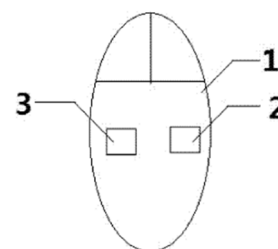
Lastly, in the **area of pulse and heart-rate measurement** (“wrist pulse”), below we look at the example of Chinese company, **SHAANXI XUNTENG COMM TECHNOLOGY (CN)**.

The majority of patents relating to pulse and heart-rate measurement at the wrist (roughly 90%) were filed with the Chinese patent office.



Example 4:

Patent application No. CN104731382, filed by **SHAANXI XUNTENG COMM TECHNOLOGY (CN)** and published in 2015, describes an electronic device that resembles a computer mouse and is capable of detecting the physical condition of the patient. The mouse features a shell, which contains a heart-beat detector and a temperature detector, as well as a display screen. The user can check their physical condition by observing the display screen.



²² <https://www.corporationwiki.com/California/San-Francisco/fitbit-inc/44927546.aspx>

²³ 88 patent families out of 154.

2.3 WHERE IS RESEARCH AND DEVELOPMENT CARRIED OUT?

With respect to first filings, the three main countries are the United States, China and Japan.

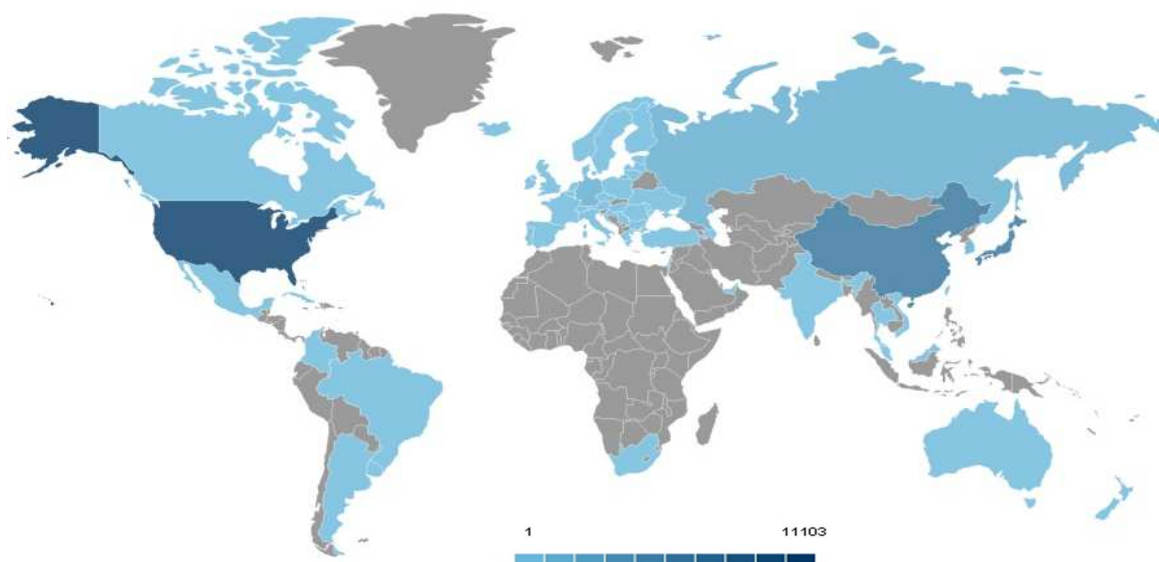
Of the 59 patent offices identified (see Appendix 4), the five main offices of first filing were the American Office (USPTO), the Chinese Office (SIPO), the Japanese Office (JPO), the Korean Office (KIPO), and the German Office (*Deutsches Patent- und Markenamt*, or DPMA). The INPI (France) was ranked in 11th position with 194 patent families over the 15 years studied. For each office, the number includes applications filed by residents and applications filed by foreign innovators who want to obtain patent protection in the country in question.

Number of patent families for the five main patent offices:

USPTO	11,103
SIPO	4,862
JPO	4,746
KIPO	1,189
DPMA	1,133

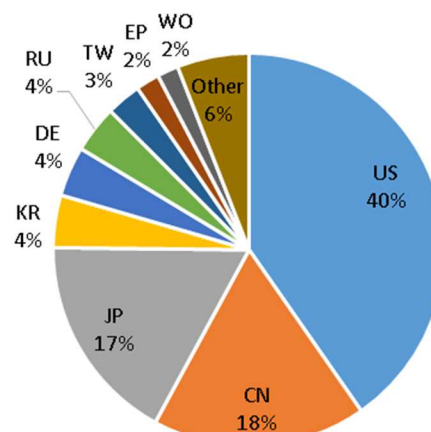
The number one cause of death worldwide, CVDs are also the main cause of death in the United States (23.5%). With a market share of 43% in the United States, the US cardiovascular devices market alone²⁴ was worth almost \$28 billion in 2014. Filings in the United States (USPTO) were more than double those made in Japan (JPO) and in China (SIPO). Over the period examined, we noted that the leading global medical devices companies based in the United States had a very active filing policy with respect to the cardiovascular diagnostic devices segment.

Figure 6: Breakdown of patent families by first priority country in the field of cardiovascular diagnostic devices (excluding EP and WO)



Source: Questel Orbit - Data processing by INPI (2016)

Figure 7: Breakdown of filings by country in the field of cardiovascular diagnostic devices



Source: Data processing by INPI (2016)

Filings with the USPTO (US) represented approximately 40% of the total, with SIPO (CN) and JPO (JP) filings accounting for 18% and 17%, respectively. The Korean (KR), German (DE) and Russian (RU) offices each recorded approximately the same number of filings, with roughly 4% each.

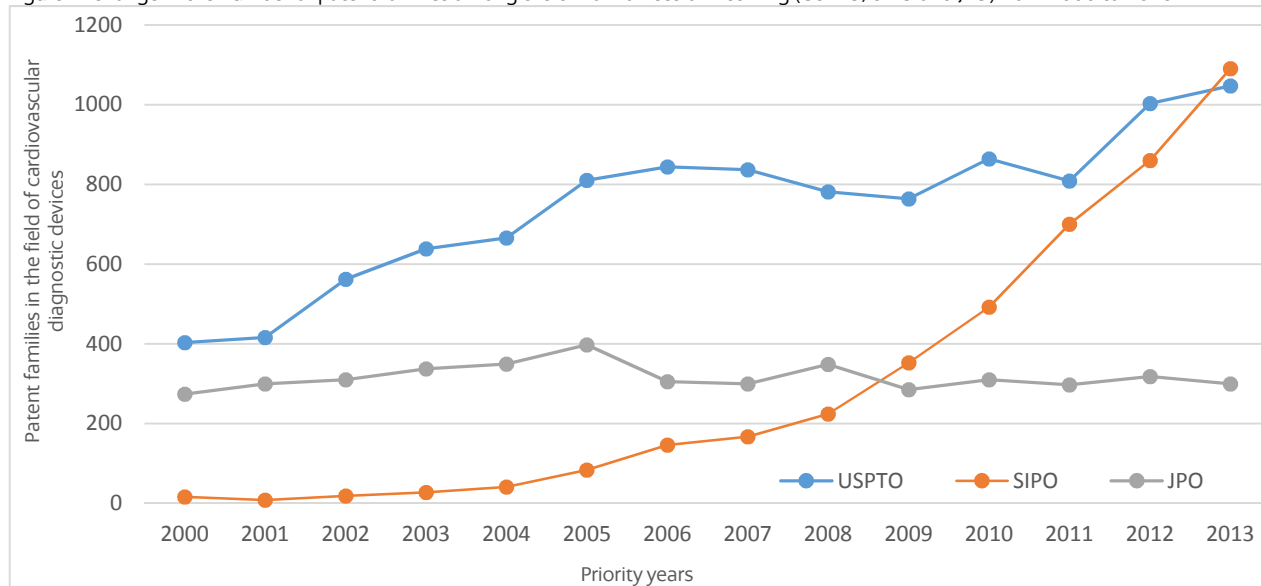
European filings with the EPO (EP) and international filings with WIPO (WO) accounted for less than 2% each.

²⁴ <http://www.grandviewresearch.com/industry-analysis/cardiovascular-devices-market>

Spotlight on the three main offices of first filing

Filings in the United States (USPTO) are increasing steadily, while filings in Japan (JPO) have been stable over the past five years. In China (SIPO), the number of filings has shot up since 2008, overtaking the US in 2013. However, by taking a closer look at the 4,862 patent families subject to first filing with the SIPO, we can see that almost half (47%) concerned utility models²⁵. Utility models, also known as “petty patents”, are traditionally used in China as they are quick and easy to obtain. They are relatively cheap compared to standard patents.

Figure 8: Change in the number of patent families among the 3 main offices of first filing (USPTO, SIPO and JPO) from 2000 to 2013



Source: Data processing by INPI (2016) - The first priority years 1999 and 2014 are not shown as the data were incomplete.

To what extent are these first filings protected abroad?

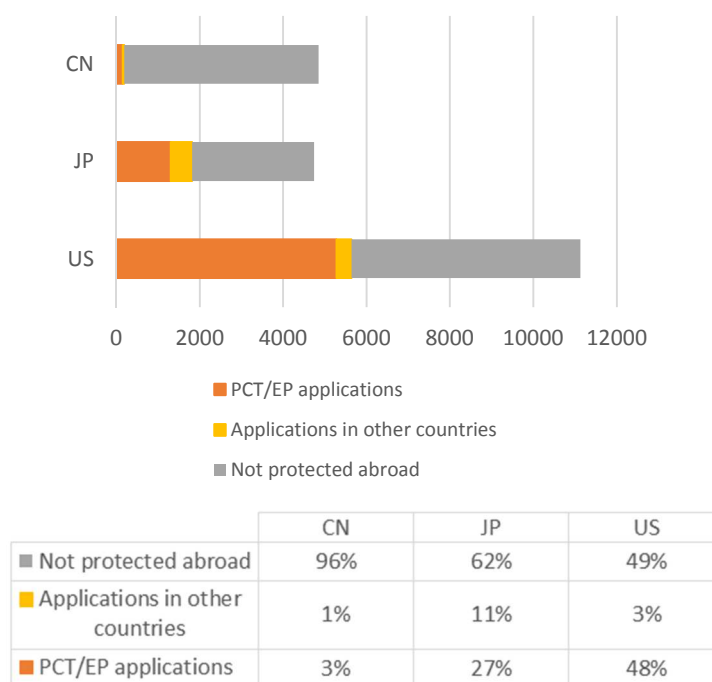
If we look at the United States for example, we can see that half of US patent applications are protected in another country. This is the biggest target market worldwide.

96% of first filings in China (SIPO) were not subject to an application in another country (i.e. international protection). It is worth noting that Chinese utility models (which made up 47%) cannot be protected outside of China.

As for first filings in Japan (JPO), 38% were filed abroad, of which 27% were subject to an international or European patent application.

With regard to first filings in the US (USPTO), approximately 51% were protected in another country, of which 48% were subject to an international or European patent application.

Figure 9: Rate of international protection for first filings with the three main offices



Source: Data processing by INPI (2016)

²⁵ See Appendix 3.

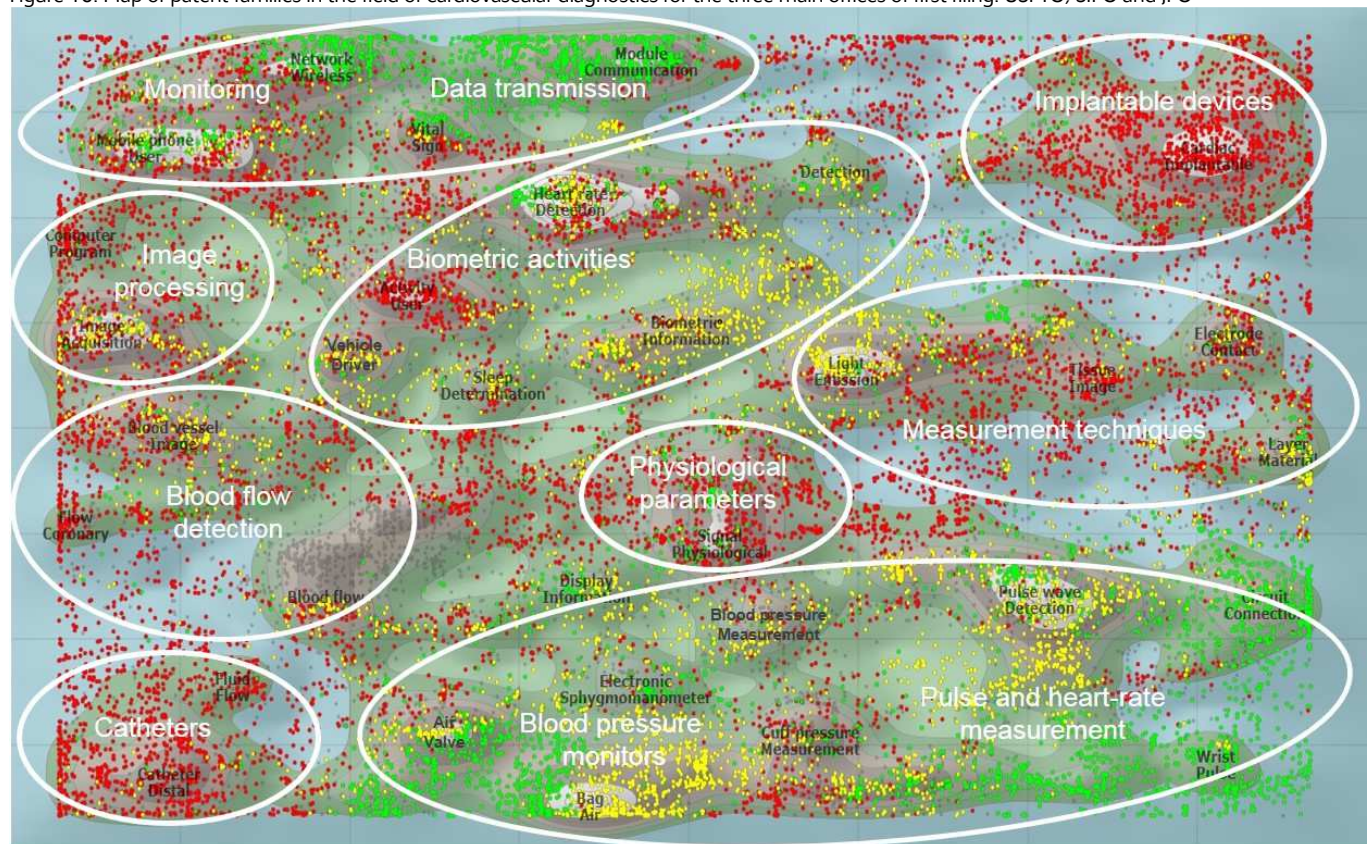
Is it possible to draw a map indicating one or several areas of technology associated with each office of filing?

The vast majority of first filings made with the **USPTO** (United States in red) concerned the **areas of implantable devices and catheters**. Filings were lower in the area of pulse and heart-rate measurement and blood pressure monitors.

The first filings made with the **SIPO** (China in green) mainly concerned the following two areas: **monitoring and data transmission**, and **pulse and heart-rate measurement and blood pressure monitors**.

As for Japan, the first filings made with the **JPO** (Japan in yellow) mainly covered three areas: **biometric activities, measurement techniques** and **pulse and heart-rate measurement and blood pressure monitors**.

Figure 10: Map of patent families in the field of cardiovascular diagnostics for the three main offices of first filing: USPTO, SIPO and JPO



Source: Clarivate Analytics - Data processing by INPI (2016)

- 11,103 patent families subject to first filing with the USPTO
- 4,862 patent families subject to first filing with the SIPO
- 4,746 patent families subject to first filing with the JPO

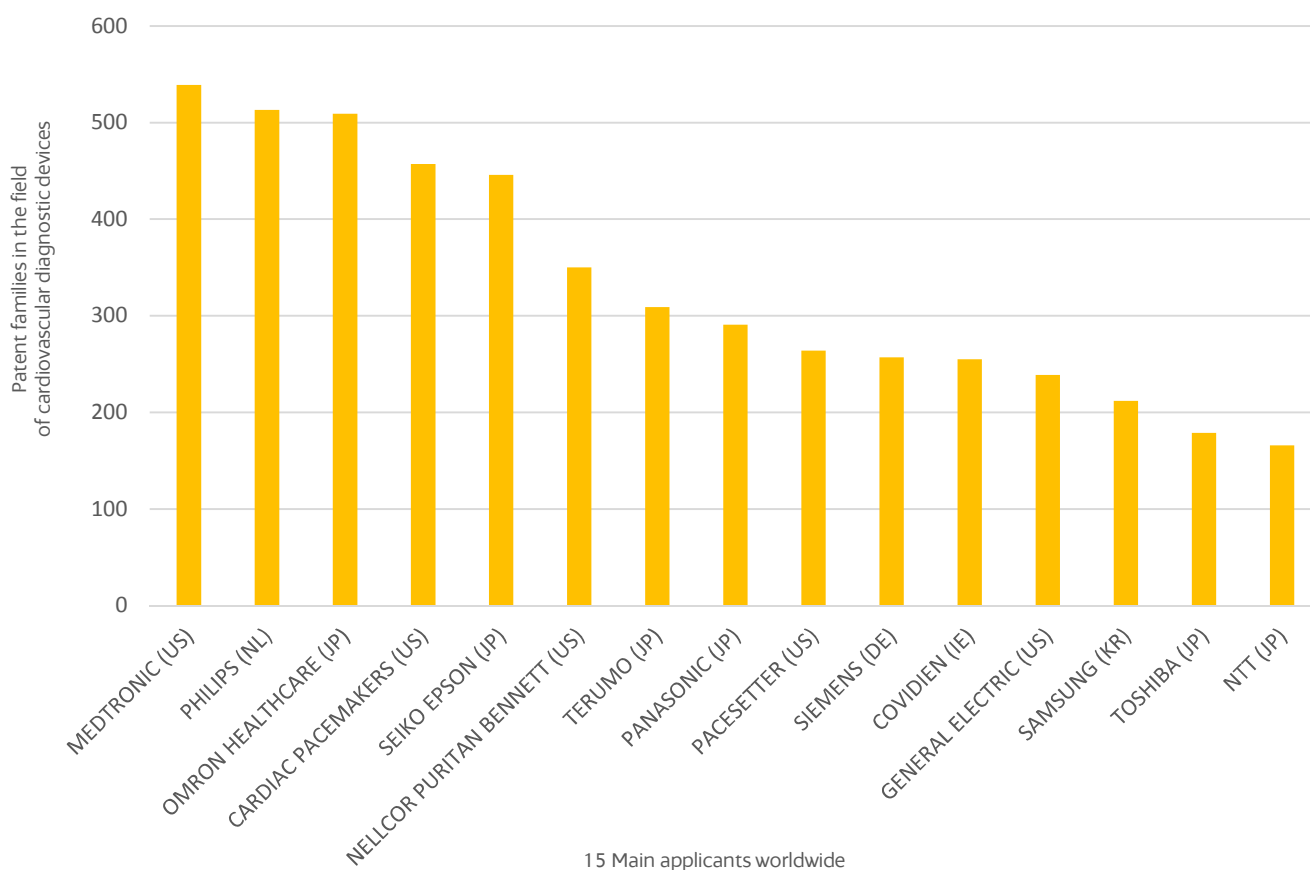
This map highlights the various areas of technology associated with each of the main offices of first filing and provides an overview of research and development activity in each of the three countries concerned.

2.4 WHO ARE THE MAIN PLAYERS?

The three main applicants in the area of cardiovascular diagnostic device patents are: MEDTRONIC (US), PHILIPS (NL) and OMRON HEALTHCARE (JP).

On a global scale, the main patent applicants²⁶ are mainly Japanese (6) and American (5) groups. Three main European companies are also included in the top 15 patent filers: Dutch company **PHILIPS** is ranked 2nd, German company **SIEMENS** is ranked 10th and Irish company **COVIDIEN**²⁷ is ranked 11th. The 15 main applicants account for 4,795 patent families, or 17% of the total number of patent families (27,552).

Figure 11: 15 main applicants worldwide in the area of cardiovascular diagnostic patents



Source: Data processed by INPI using Intellixir software (2016)

The three main applicants worldwide are US company **MEDTRONIC**²⁸, the leader in the medical devices market, followed by Dutch company **PHILIPS**²⁹, the leader in prevention, diagnosis and treatment of cardiovascular disease, and lastly Japanese company **OMRON HEALTHCARE**³⁰, the leader on the blood pressure monitor market.

JOHNSON & JOHNSON and ROCHE, both identified as dominant players in the medical devices market (see section 1.2), are not represented among the 15 main patent applicants.

²⁶ Based on applicant data in the Derwent World Patents Index (DWPI) database, grouped and processed by INPI.

²⁷ COVIDIEN was acquired by MEDTRONIC in 2015: <http://newsroom.medtronic.com/phoenix.zhtml?c=251324&p=irol-newsArticle&ID=2010595>

²⁸ http://www.medtronic.com/fr-fr/index.html?cmpid=mdt_fr_orcle_home_f52_plc_home

²⁹ <http://www.philips.fr/a-w/about/news.html>

³⁰ <https://www.omron-healthcare.com/fr/products/bloodpressuremonitoring>

The change in R&D investment by the 15 main applicants can be analysed more closely by looking at the course of filings over time.

It is interesting to compare the number of filings per year as it is clearer to see the players that have filed a lot of patents recently, such as **PHILIPS (NL)**, **SEIKO EPSON (JP)** and **COVIDIEN (IE)**.

Figure 12: Change in the number of patent families held by the 15 main applicants in the area of cardiovascular diagnostic patents (by first priority date)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
MEDTRONIC (US)	6	16	22	20	51	64	45	35	40	49	35	53	52	28	15	8	539
PHILIPS (NL)	3	3	11	14	17	25	35	36	39	57	42	26	51	63	56	35	513
OMRON HEALTHCARE (JP)	7	26	35	31	21	33	30	32	11	97	36	39	34	57	12	8	509
CARDIAC PACEMAKERS (US)	10	3	10	50	48	22	77	69	51	29	26	17	12	5	20	8	457
SEIKO EPSON (JP)	6	23	17	37	23	20	27	15	17	18	20	40	63	37	53	30	446
NELLCOR PURITAN BENNETT (US)	1	2	14	1	7	17	15	20	15	51	50	32	40	85	0	0	350
TERUMO (JP)	1	4	5	7	6	34	55	28	20	17	35	38	17	26	12	4	309
PANASONIC (JP)	21	29	25	27	29	22	25	18	26	8	13	14	11	8	10	5	291
PACESETTER (US)	10	3	3	10	6	28	31	33	34	20	19	18	15	13	17	4	264
SIEMENS (DE)	4	6	4	7	9	6	34	21	22	22	23	25	22	23	13	16	257
COVIDIEN (IE)	2	3	6	2	3	5	12	10	13	18	16	21	31	58	48	7	255
GENERAL ELECTRIC (US)	2	1	0	1	4	10	28	32	31	30	19	22	15	17	23	4	239
SAMSUNG (KR)	0	3	2	10	7	18	11	11	16	20	29	7	7	21	26	24	212
TOSHIBA (JP)	1	5	3	7	5	6	16	18	11	14	11	20	5	19	26	12	179
NTT (JP)	0	2	1	2	7	43	73	8	6	7	2	6	1	3	2	3	166

15 main applicants worldwide/by first priority date

Source: Data processed by INPI using Intellixir software (2016) - The first priority years 1999 and 2014 are dotted due to incomplete data.

Filings by **PHILIPS (NL)** have steadily grown over the years. In December 2014, the company acquired **VOLCANO CORP (US)**, a medical equipment company specialised in catheters³¹, which will enable it to continue its expansion.

By analysing the table data, we can see the emergence of electronic specialist **SEIKO EPSON (JP)**³² since 2010. From 2010 to 2014, the company made a remarkable number of filings and became a major player in the field (see example 5 below), gaining second position behind PHILIPS.

COVIDIEN (IE)³³, along with **NELLCOR PURITAN BENNETT (US)**³⁴—its subsidiary since 2007—, has a huge patent portfolio (see example 6 below). **MEDTRONIC (US)** has filed fewer patents since 2012, but it does have an active development policy since it finalised the acquisition of **COVIDIEN (IE)** in 2015 in order to create synergies with the latter.

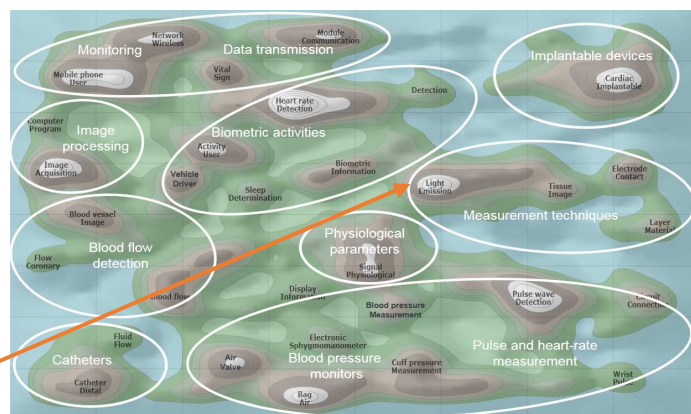
³¹ <http://www.reuters.com/article/us-volcano-m-a-philips-idUSKBN0JVOG120141217>

³² <https://www.epson.fr/verticals/healthcare>

³³ <https://fr.wikipedia.org/wiki/Covidien>

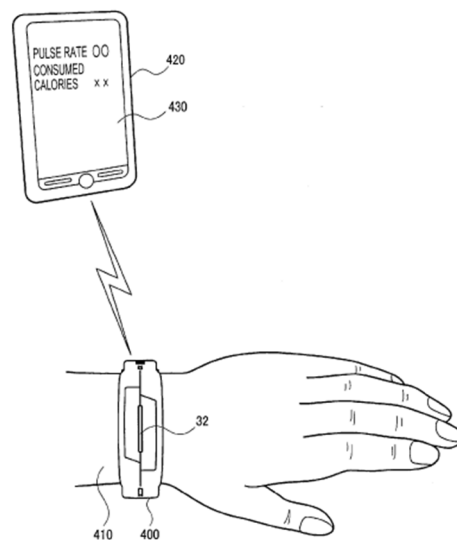
³⁴ https://en.wikipedia.org/wiki/Puritan_Bennett

High-tech company **SEIKO EPSON (JP)** develops patents in a number of cutting-edge areas, for example in the **area of measurement techniques** (“light emission”).

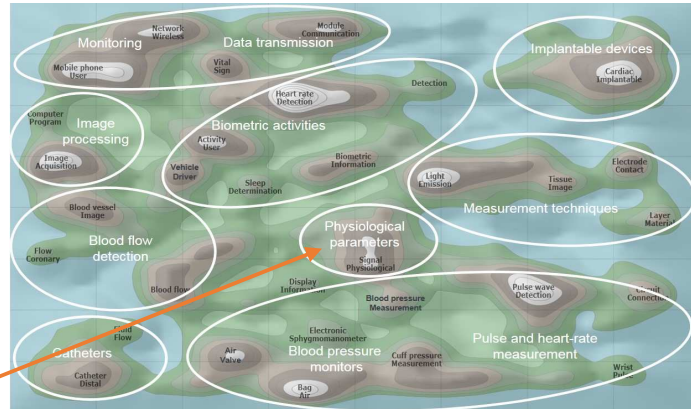


Example 5:

Patent application no. WO2015146139, filed by **SEIKO EPSON(JP)** and published in 2015, describes a biological information detection device which includes a first light receiving portion which receives light from a subject; a second light receiving portion which receives light from the subject; and a light-transmissive member.

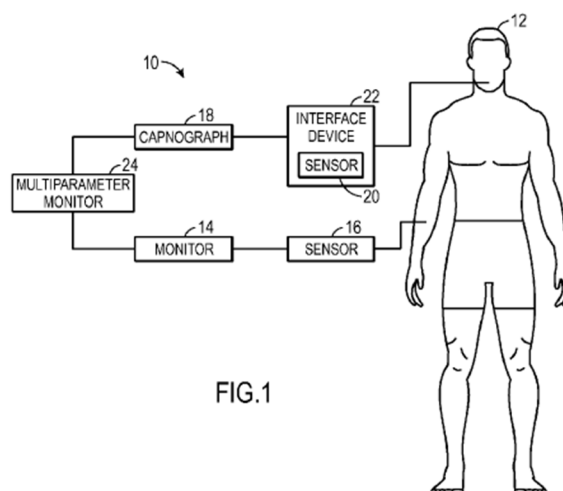


A number of patents filed by high-tech company **COVIDIEN (IE)** concern **physiological parameters** (in particular “physiological signals”).



Example 6:

Patent application no. WO2015188079, filed by **COVIDIEN (IE)** and published in 2015, concerns methods and systems which determine whether a patient is breathing irregularly. The system may analyse the signal for one or several features indicative of irregular breathing, which may be a result of a patient talking, moving, yawning, coughing, sneezing, or the like. The system may also be configured to provide an indication of irregular breathing.



What is the development strategy of the 15 main players?

It is crucial to protect inventions abroad so as to create sales strategies and to manufacture and distribute the related products. By comparing international protection strategies, we can see the different markets targeted by companies. This analysis can be carried out on a macro level (by country or patent office) or in more detail, by examining protection strategies “company by company”.

Based on the ten patent offices below, **PHILIPS (NL)** has the most extensive international protection policy.

PHILIPS (NL) targets the Indian market and, like its competitor **OMRON HEALTHCARE (JP)**, also protects its inventions in Russia. **CARDIAC PACEMAKERS (US)**, **NELLCOR PURITAN BENNETT (US)** and **COVIDIEN (IE)** all target the Australian market.

The US market is a prime target for all of the European companies: **PHILIPS (NL)**, **COVIDIEN (IE)** and **SIEMENS (DE)**. Japanese companies **TERUMO (JP)**, **PANASONIC (JP)** and **NTT (JP)** have a very limited international protection policy as their target cardiovascular diagnostic devices market is mainly local.

The figures below take into account both the country of origin or the priority country where the patent application was filed, and the countries to which protection was extended. A single country is counted for each patent family. For example, the patent family comprising:

US20150032014,

US9132274,

US20160067498,

WO2015013541,

EP3024386,

and CN105578955,

is counted once in the US, WO, EP and CN columns.

Figure 13: Protection strategy for cardiovascular diagnostic device patents filed by the 15 main applicants worldwide with 10 patent offices.

	US	JP	PCT	EP	CN	DE	KR	IN	RU	AU
MEDTRONIC (US)	539	43	326	195	46	41	0	15	0	14
PHILIPS (NL)	425	335	491	448	362	38	23	151	93	19
OMRON HEALTHCARE (JP)	268	499	198	113	254	164	70	15	88	9
CARDIAC PACEMAKERS (US)	457	121	169	142	27	16	0	1	1	53
SEIKO EPSON (JP)	175	446	36	70	93	8	1	2	0	0
NELLCOR PURITAN BENNETT (US)	350	37	141	78	15	14	12	18	0	40
TERUMO (JP)	43	284	59	28	23	4	3	1	0	2
PANASONIC (JP)	78	289	71	54	52	15	8	3	1	3
PACSETTER (US)	264	2	4	27	0	7	0	0	0	2
SIEMENS (DE)	213	38	26	25	75	170	10	6	0	1
COVIDIEN (IE)	254	22	95	53	16	5	9	13	1	31
GENERAL ELECTRIC (US)	236	65	16	37	70	68	1	7	0	0
SAMSUNG (KR)	179	45	17	61	44	8	207	1	1	1
TOSHIBA (JP)	149	171	34	14	57	2	3	0	0	1
NTT (JP)	8	166	8	7	7	3	3	0	0	0

15 main applicants worldwide/10 patent offices

Source: Data processed by INPI using Intellixir software (2016)

This table provides both the number of patent families per country of first filing and by country to which protection is extended.

Among the 15 main players, which applicants hold triadic patent families in their patent portfolio?

Triadic patent families³⁵ are defined as those patents applied for at the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO) to protect a same invention.

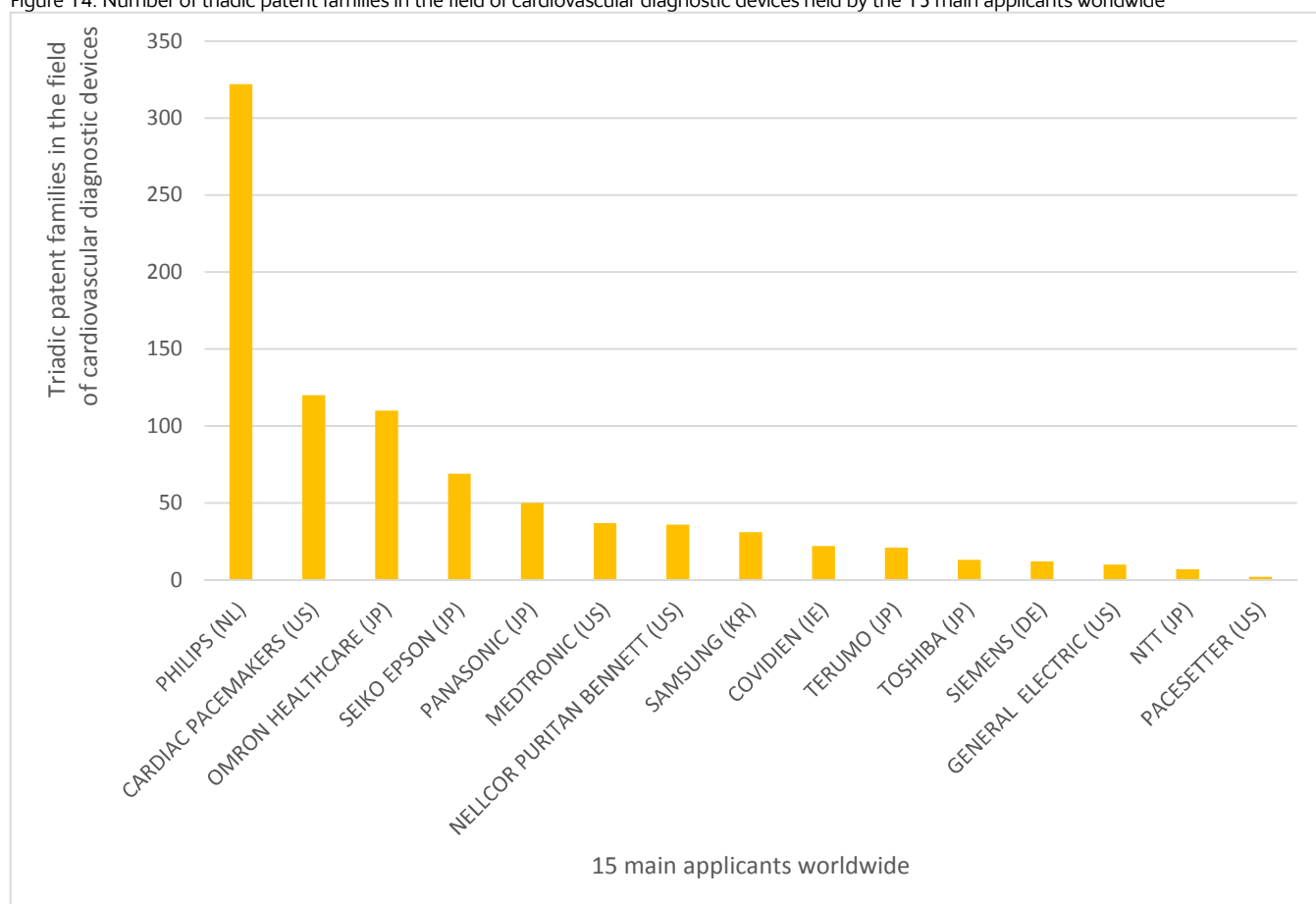
In general, these patent families have a high value. The holders of this type of patent portfolio incur additional costs and accept the time involved in extending protection to other countries when they deem it necessary.

Triadic patents are typically of higher value and eliminate biases arising from home advantage and the influence of geographical location.

Out of the 27,552 patent families studied, we identified 3,101 triadic patent families³⁶, making up 11%. Inventions that are protected on the three main markets (i.e. the US-EU-Japan triad) are recognised as having the best sales potential.

Out of the 4,795 patent families belonging to the 15 main applicants, the number of triadic patent families is equal to 847, or 18% overall.

Figure 14: Number of triadic patent families in the field of cardiovascular diagnostic devices held by the 15 main applicants worldwide



Source: Data processed by INPI using Intellixir software (2016)

PHILIPS (NL) holds a remarkable 322 triadic patent families.

³⁵ <http://www.oecd.org/site/innovationstrategy/45184357.pdf>

³⁶ See Appendices 2 and 3

2.5 SPOTLIGHT ON THE THREE MAIN PLAYERS

The three main players are positioned on different markets.

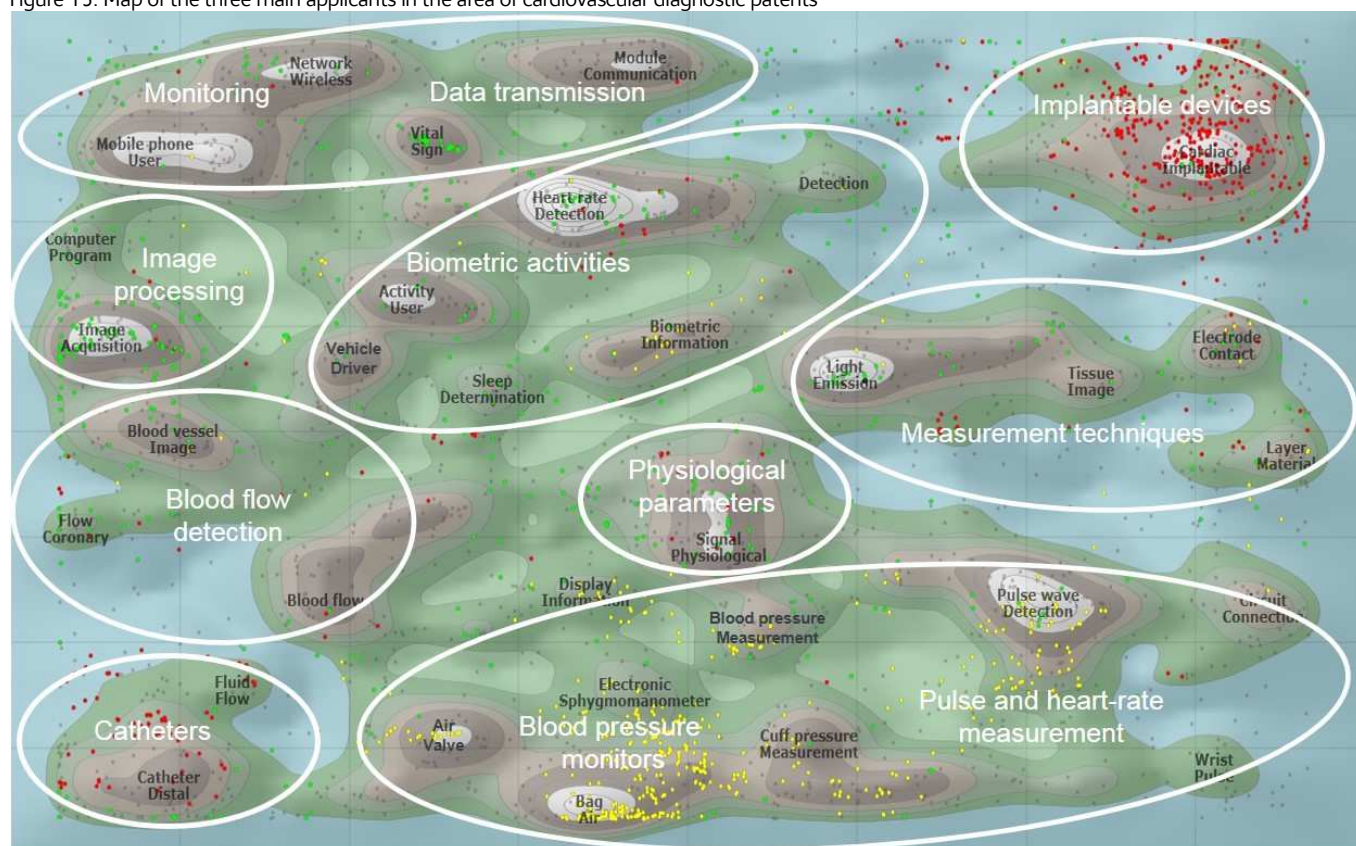
By looking at the three main patent applicants on the map, we can see that they innovate in different fields of technology.

MEDTRONIC (US) ●, which specialises in pacemakers, is mainly positioned in the area of implantable devices.

PHILIPS (NL) ● is positioned in nine main fields.

OMRON HEALTHCARE (JP) ● mainly invents devices for measuring blood pressure (blood pressure monitors).

Figure 15: Map of the three main applicants in the area of cardiovascular diagnostic patents



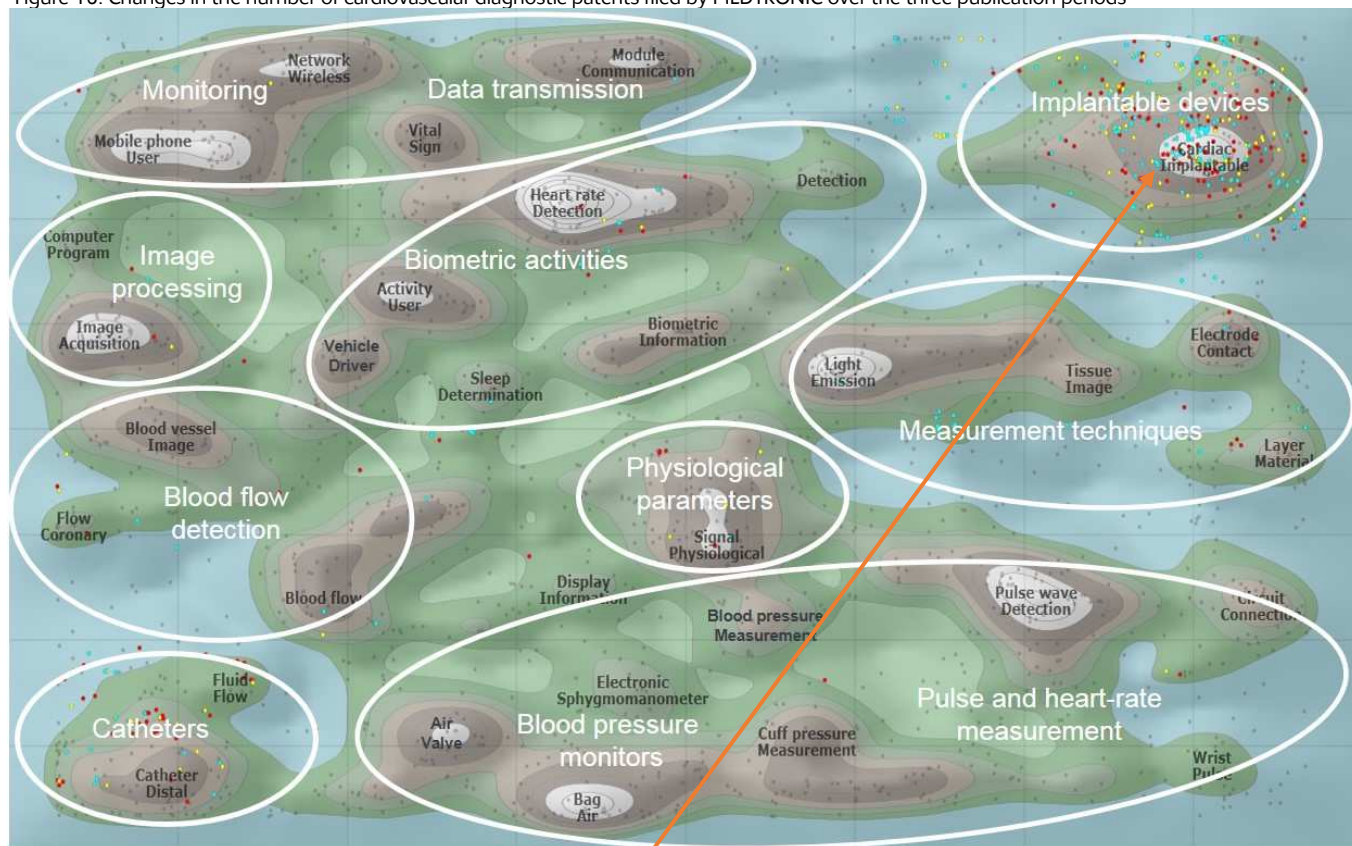
Source: Clarivate Analytics - Data processing by INPI (2016)

● MEDTRONIC: 539 patent families
● PHILIPS: 513 patent families
● OMRON HEALTHCARE: 509 patent families

By analysing three five-year publication periods, we were able to identify the fields in which **MEDTRONIC (US)**, **PHILIPS (NL)** and **OMRON HEALTHCARE (JP)** have developed the most technology.

Over the three periods, publications relating to **MEDTRONIC (US)** have mainly concerned the areas of **implantable devices and catheters**. **Pacemakers** remain the company's main area of innovation.

Figure 16: Changes in the number of cardiovascular diagnostic patents filed by MEDTRONIC over the three publication periods



Source: Clarivate Analytics - Data processing by INPI (2016)

● 116 patent families filed by MEDTRONIC, 2001-2005 period
 ● 227 patent families filed by MEDTRONIC, 2006-2010 period
 ● 193 patent families filed by MEDTRONIC, 2011-2015 period

A recent patent filed by **MEDTRONIC (US)** in the **area of implantable devices** ("**implantable cardiac devices**") also concerns the electronic processing of digital data.

Example 7:

Patent no. US9533156, filed by **MEDTRONIC (US)** and issued in 2016, describes an implantable medical device system and a related process for calculating the control parameters of automatically delivered therapy, such as a cardiac pacing therapy and/or the assessment of the patient's condition.

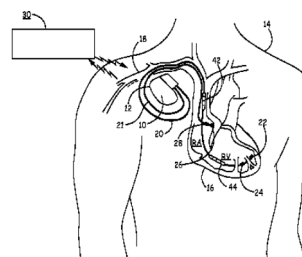
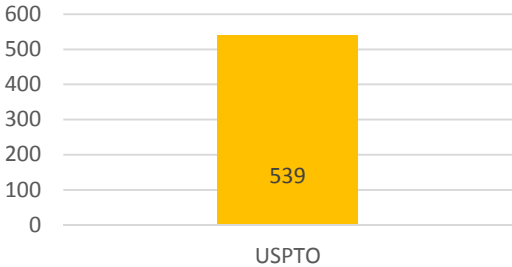
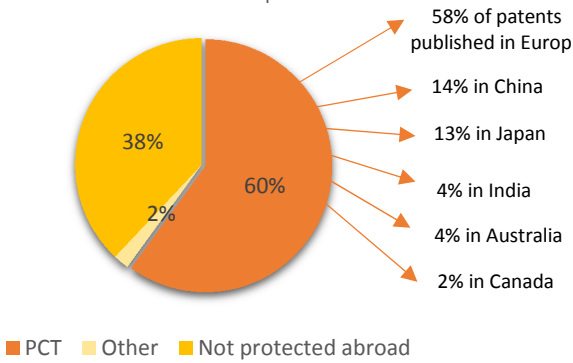
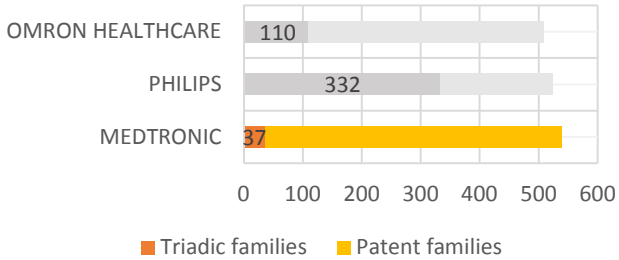
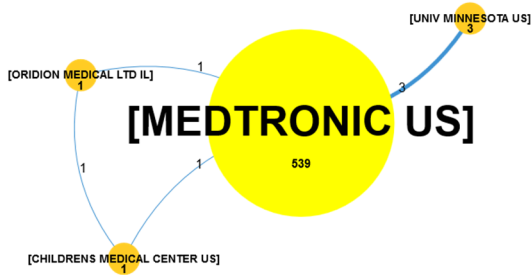


FIG. 1

What important information can we learn about MEDTRONIC's filing and international protection policy by analysing its 539 patent families?

In 2016, MEDTRONIC had operations in approximately 160 countries and recorded total revenue³⁷ of \$28.8 billion. Its cardiovascular activities made up over 35% of the company's annual revenue (\$10.2 billion in 2016).

<p>First filings exclusively in the United States</p> <p>MEDTRONIC carries out its first filings exclusively in the United States.</p> <p>Its R&D activity is based in the United States, and 60% of its current market is also based there (all sectors combined).</p>	<p>Figure 16.1: Number of patent families by office of filing</p>  <table border="1"><thead><tr><th>Office of filing</th><th>Number of patent families</th></tr></thead><tbody><tr><td>USPTO</td><td>539</td></tr></tbody></table>	Office of filing	Number of patent families	USPTO	539								
Office of filing	Number of patent families												
USPTO	539												
<p>Regarding the company's filing strategy, MEDTRONIC's main market is the United States and its second market is Europe.</p> <p>This international patent protection strategy is consistent with MEDTRONIC's development strategy in all sectors.</p> <p>60% of patent applications filed in the United States were filed as an international patent application (PCT/WO).</p> <p>It should be noted that roughly 17% of these filings were validated in France.</p>	<p>Figure 16.2: International protection and breakdown of MEDTRONIC's patent families</p>  <table border="1"><thead><tr><th>Category</th><th>Percentage</th></tr></thead><tbody><tr><td>PCT</td><td>60%</td></tr><tr><td>Not protected abroad</td><td>38%</td></tr><tr><td>Other</td><td>2%</td></tr></tbody></table> <p>Breakdown of PCT patents:</p> <ul style="list-style-type: none">58% of patents published in Europe14% in China13% in Japan4% in India4% in Australia2% in Canada	Category	Percentage	PCT	60%	Not protected abroad	38%	Other	2%				
Category	Percentage												
PCT	60%												
Not protected abroad	38%												
Other	2%												
<p>Very few triadic families³⁸</p> <p>7% of MEDTRONIC's patent families were filed in Europe, the United States and Japan. They probably concern the company's best inventions. MEDTRONIC therefore holds very few triadic patent families compared to the average of 11% across all patent filings in the field.</p> <p>This can be attributed to the fact that few patents are protected in Japan as MEDTRONIC does not generally target the Asian market (16% of revenue in 2016).</p>	<p>Figure 16.3: Number of triadic patent families held by the three main players</p>  <table border="1"><thead><tr><th>Company</th><th>Triadic families</th><th>Patent families</th></tr></thead><tbody><tr><td>OMRON HEALTHCARE</td><td>110</td><td>500</td></tr><tr><td>PHILIPS</td><td>332</td><td>500</td></tr><tr><td>MEDTRONIC</td><td>37</td><td>539</td></tr></tbody></table>	Company	Triadic families	Patent families	OMRON HEALTHCARE	110	500	PHILIPS	332	500	MEDTRONIC	37	539
Company	Triadic families	Patent families											
OMRON HEALTHCARE	110	500											
PHILIPS	332	500											
MEDTRONIC	37	539											
<p>The company rarely works with third parties and does not outsource its R&D activities.</p> <p>Relations between applicants are denoted by a blue line with the number of patent families in common.</p>	<p>Figure 16.4: Partnership networks</p>  <pre>graph LR OM["[ORIDION MEDICAL LTD IL]"] --- 1 MCUS["[CHILDRENS MEDICAL CENTER US]"] OM --- 1 MEDUS["[MEDTRONIC US] 539"] MCUS --- 1 MEDUS UNM["[UNIV MINNESOTA US]"] --- 3 MEDUS</pre>												

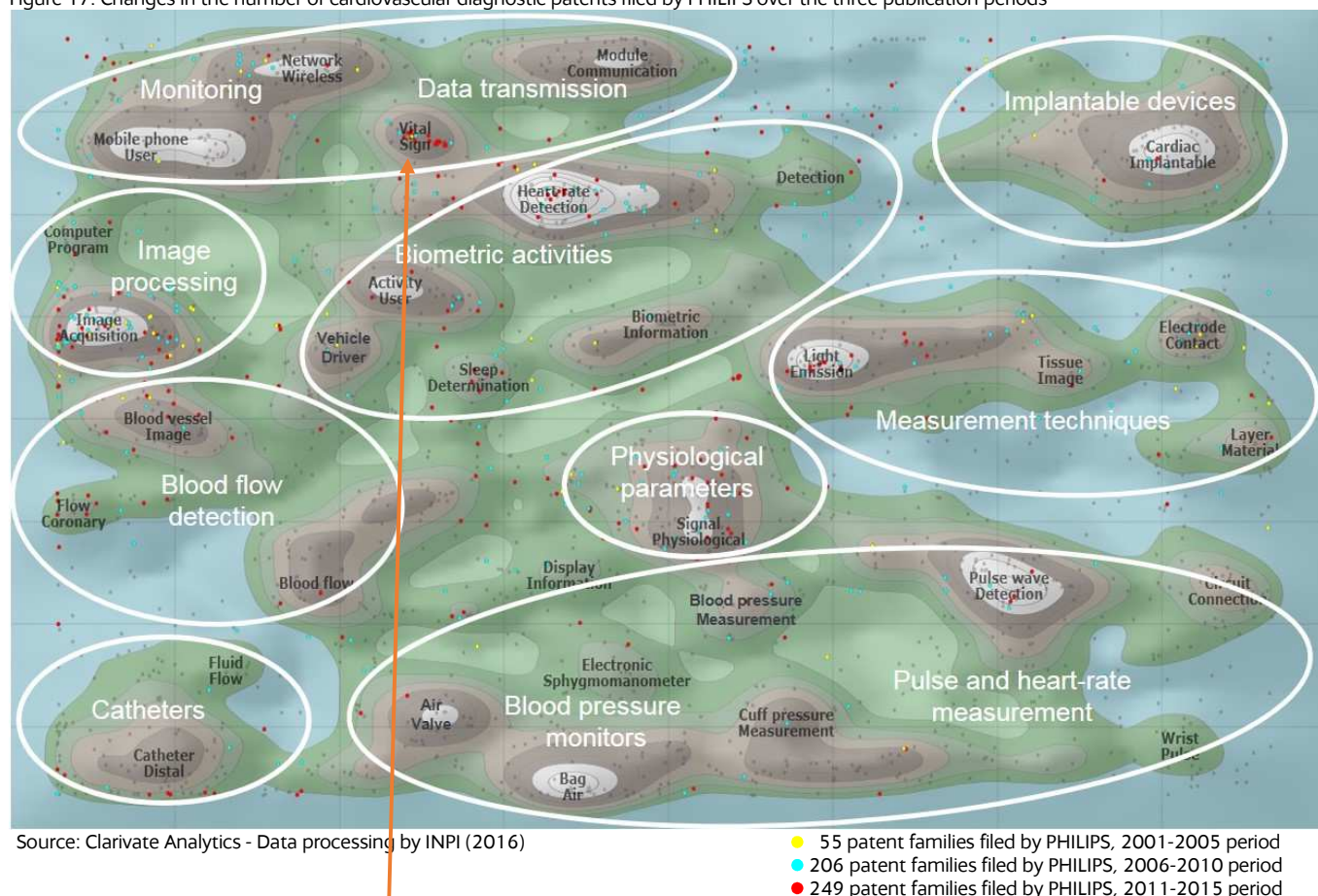
Source: Clarivate Analytics - Data processed by INPI using Intellixir software (2016)

³⁷ http://www.medtronic.com/content/dam/medtronic-com/us-en/corporate/documents/17267.MED.Sustainability.Report_4_FINAL%20NOV%208.pdf

³⁸ See Appendices 2 and 3

PHILIPS (NL), which has been present in the areas of **image processing and monitoring and data transmission** since 2001, **has diversified its activities across all fields since 2006**. The number of filings made by the company increased from 2006 onwards.

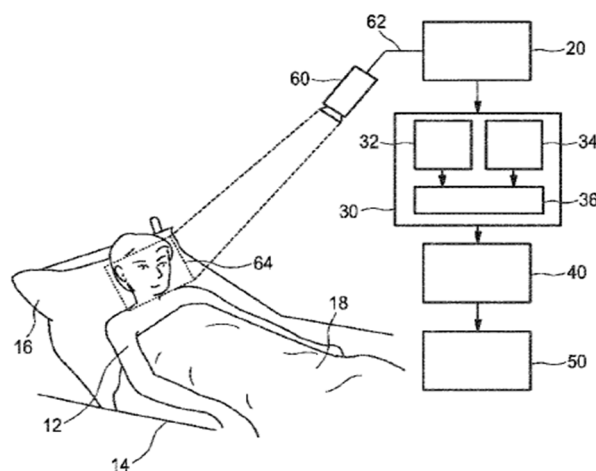
Figure 17: Changes in the number of cardiovascular diagnostic patents filed by PHILIPS over the three publication periods



A recent patent filed by **PHILIPS (NL)** in the **area of data transmission (“vital signs”)** also concerns image data processing and generation.

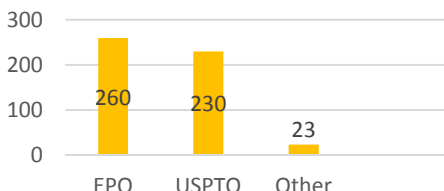
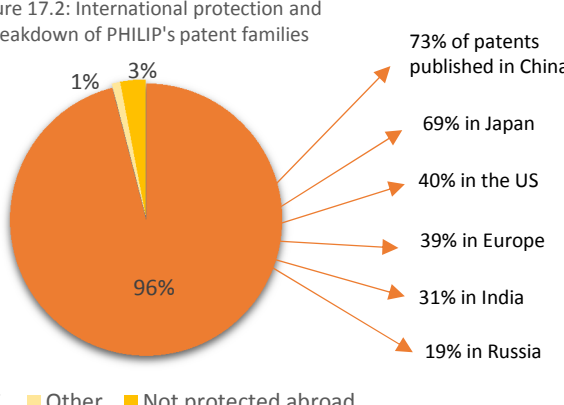
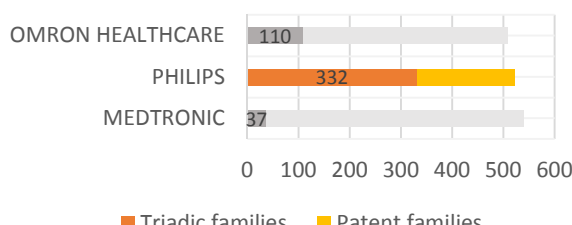
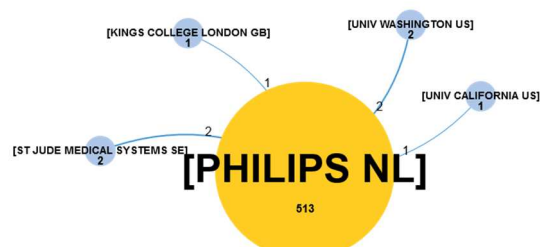
Example 8:

Patent application no. WO2015055709, filed by **PHILIPS (NL)** and published in 2015, describes a device for obtaining vital sign information, such as the heart rate, blood oxygen saturation or respiratory information of a subject, using a camera and by extracting photoplethysmographic signals remotely in a hospital.



What important information can we learn about PHILIPS' (NL) filing and international protection policy by analysing its 513 patent families?

PHILIPS boasts a very large international market. In 2016, it recorded revenue of €24.5 billion, with a significant share coming from the medical sector. The company's objective is to increase the share of its medical activity to 60%³⁹.

<p>First filings are split between Europe and the United States.</p> <p>PHILIPS' two main offices of first filing are the EPO (51%) and the USPTO (45%). Its R&D activity is based in Europe and in the United States.</p>	<p>Figure 17.1: Number of patent families by office of filing</p>  <table><tr><th>Office of filing</th><th>Number of patent families</th></tr><tr><td>EPO</td><td>260</td></tr><tr><td>USPTO</td><td>230</td></tr><tr><td>Other</td><td>23</td></tr></table>	Office of filing	Number of patent families	EPO	260	USPTO	230	Other	23				
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USPTO	230												
Other	23												
<p>Regarding the company's filing strategy, its main market is Europe, followed by the United States and Asia in that order.</p> <p>96% of its first filings were submitted as an international patent application (PCT/WO). PHILIPS almost systematically seeks protection of its patents internationally. This would appear to reflect a balanced market across the various geographic regions, including in emerging countries. We can see that PHILIPS has a tendency to seek protection in countries such as China (approx. 2/3 of filings), India (approx. 1/3) and Russia (approx. 1/5), which shows that the group's global policy is to steer its market towards these countries. Indeed, sales in emerging countries currently account for more than 34% of the group's total revenue (across all sectors), followed by the North American market and then Europe⁴⁰.</p> <p>It should be noted that roughly 21% of filings were validated in France.</p>	<p>Figure 17.2: International protection and breakdown of PHILIPS's patent families</p>  <table><tr><th>Category</th><th>Percentage</th></tr><tr><td>PCT</td><td>96%</td></tr><tr><td>Other</td><td>3%</td></tr><tr><td>Not protected abroad</td><td>1%</td></tr></table> <p>Breakdown of PCT filings by region:</p> <ul style="list-style-type: none">73% of patents published in China69% in Japan40% in the US39% in Europe31% in India19% in Russia	Category	Percentage	PCT	96%	Other	3%	Not protected abroad	1%				
Category	Percentage												
PCT	96%												
Other	3%												
Not protected abroad	1%												
<p>A high proportion of triadic patents</p> <p>63% of PHILIPS' patent families were filed in Europe, the United States and Japan. They probably concern the company's best inventions.</p> <p>Compared to the two other main players, OMRON HEALTHCARE and MEDTRONIC, PHILIPS has the largest portfolio of triadic patents.</p>	<p>Figure 17.3: Number of triadic families held by the three main players</p>  <table><tr><th>Player</th><th>Triadic families</th><th>Patent families</th></tr><tr><td>OMRON HEALTHCARE</td><td>110</td><td>-</td></tr><tr><td>PHILIPS</td><td>332</td><td>-</td></tr><tr><td>MEDTRONIC</td><td>37</td><td>-</td></tr></table>	Player	Triadic families	Patent families	OMRON HEALTHCARE	110	-	PHILIPS	332	-	MEDTRONIC	37	-
Player	Triadic families	Patent families											
OMRON HEALTHCARE	110	-											
PHILIPS	332	-											
MEDTRONIC	37	-											
<p>The company rarely works with third parties and does not outsource its R&D activities.</p> <p>Relations between applicants are denoted by a blue line with the number of patent families in common.</p>	<p>Figure 17.4: Partnership networks</p> 												

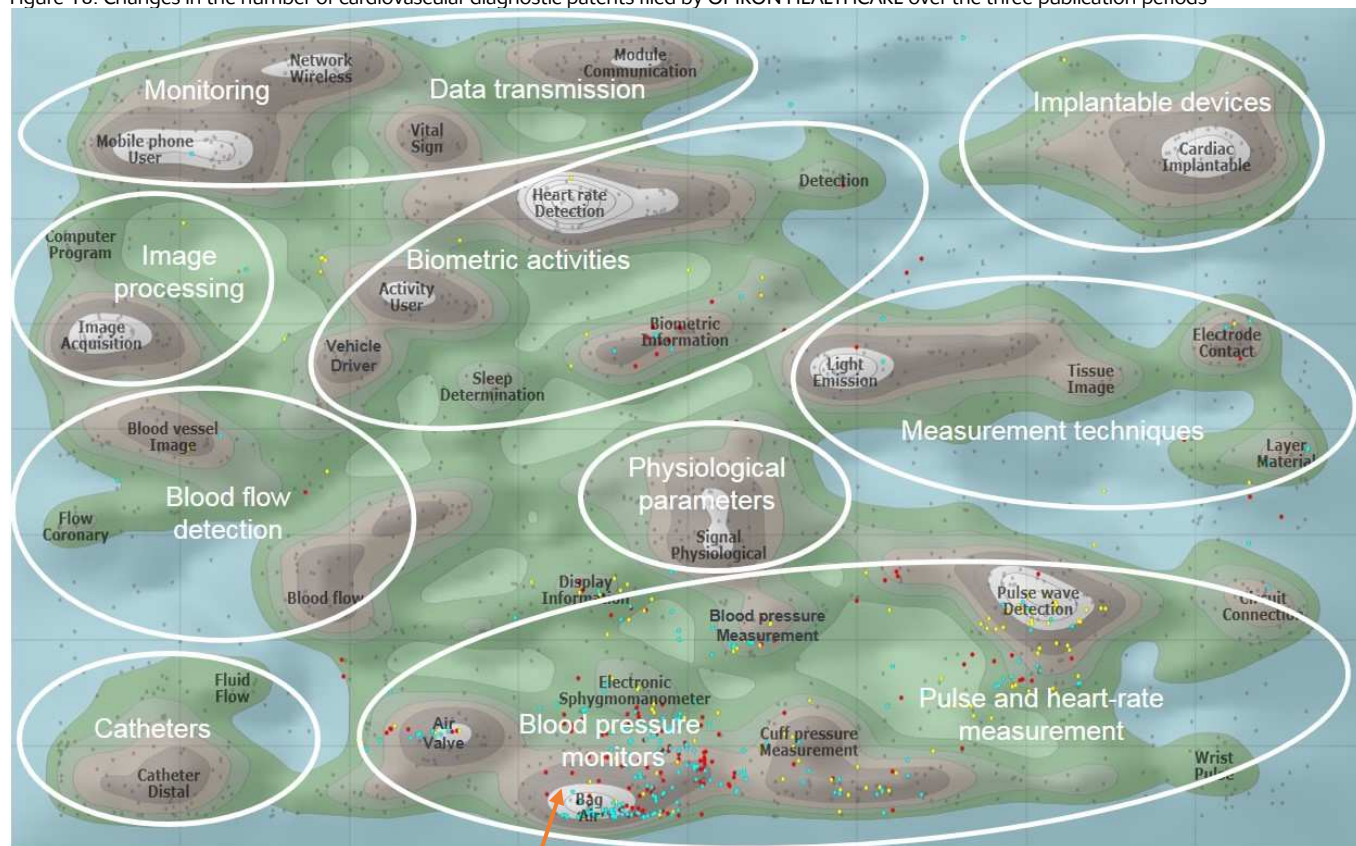
Source: Clarivate Analytics - Data processed by INPI using Intellixir software (2016)

³⁹ https://www.lesechos.fr/14/04/2017/LesEchos/22426-069-ECH_philips-mise-sur-la-mutation-des-systemes-de-sante.htm# "Philips is focusing on the transformation of health systems" (in French)

⁴⁰ http://www.philips.com/static/annualresults/2016/PhilipsFullAnnualReport2016_English.pdf

OMRON HEALTHCARE (JP) has been specialising in **pulse and heart-rate measurement** devices since 2001 and, in particular, **blood pressure monitors** which it continues to improve. The last 5-year period shows a drop in filings.

Figure 18: Changes in the number of cardiovascular diagnostic patents filed by OMRON HEALTHCARE over the three publication periods



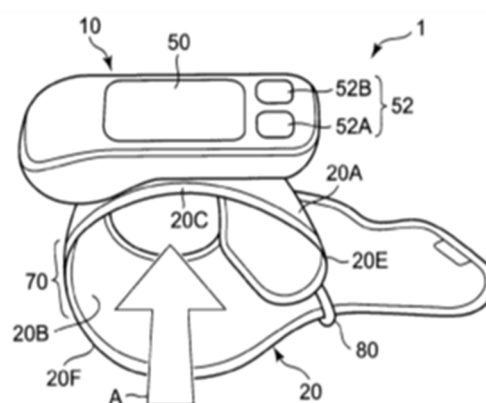
Source: Clarivate Analytics - Data processing by INPI (2016)

● 135 patent families filed by OMRON HEALTHCARE, 2001-2005 period
 ● 211 patent families filed by OMRON HEALTHCARE, 2006-2010 period
 ● 161 patent families filed by OMRON HEALTHCARE, 2011-2015 period

OMRON HEALTHCARE (JP) recently filed a patent in the **area of blood pressure monitors** (“bag air”).

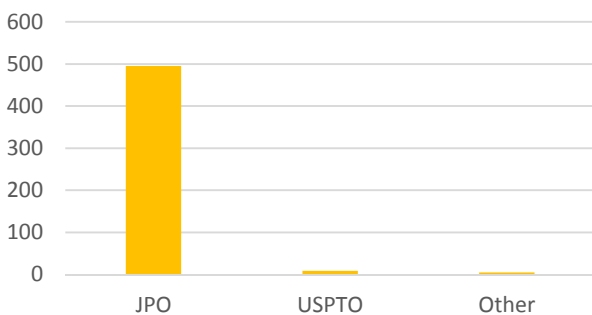
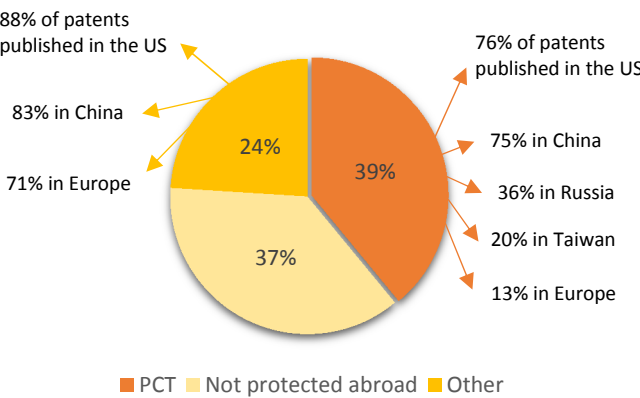
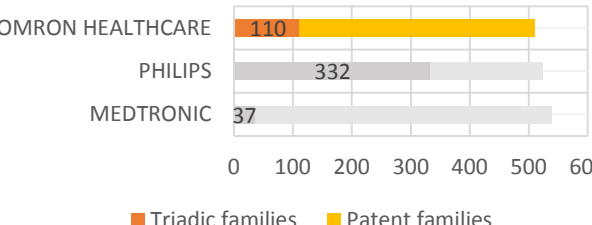
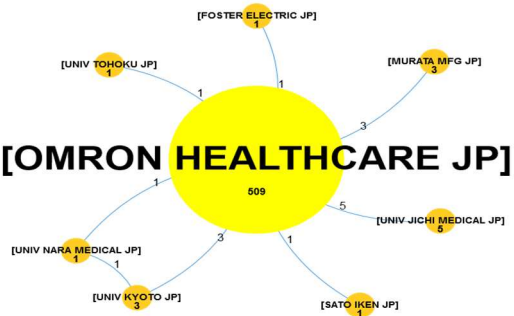
Example 9:

Patent application no. WO2015098566, filed by **OMRON HEALTHCARE (JP)** and published in 2015, describes a blood pressure measurement cuff which helps decrease the loss of compression.



What important information can we learn about OMRON HEALTHCARE's filing and international protection policy by analysing its 509 patent families?

OMRON⁴¹ recorded total revenue of \$7.6 billion in 2015. Its medical arm OMRON HEALTHCARE accounted for 13% of that figure.

<p>First filings mainly carried out in Japan</p> <p>OMRON carries out almost all of its first filings with the JPO. Like MEDTRONIC, OMRON HEALTHCARE carries out nearly all of its first filings nationally. Its R&D activity is mainly based in Japan.</p>	<p>Figure 18.1: Number of patent families by office of filing</p>  <table><tr><th>Office of filing</th><th>Number of patent families</th></tr><tr><td>JPO</td><td>~500</td></tr><tr><td>USPTO</td><td>~10</td></tr><tr><td>Other</td><td>~10</td></tr></table>	Office of filing	Number of patent families	JPO	~500	USPTO	~10	Other	~10				
Office of filing	Number of patent families												
JPO	~500												
USPTO	~10												
Other	~10												
<p>Regarding the company's filing and international protection strategy, OMRON HEALTHCARE's main market is Japan, followed by the United States and then China.</p> <p>39% of its first filings were subject to an international patent application (PCT/WO).</p> <p>OMRON HEALTHCARE has a moderate international patent protection policy. Its market is predominantly Asian (70%, including 40% in Japan). The US market and the European market represent 16% and 14% respectively.</p> <p>It should be noted that roughly 4% of filings were validated in France.</p>	<p>Figure 18.2: International protection rate and distribution of OMRON HEALTHCARE's patent families</p>  <table><tr><th>Category</th><th>Percentage</th></tr><tr><td>PCT</td><td>39%</td></tr><tr><td>Not protected abroad</td><td>37%</td></tr><tr><td>Other</td><td>24%</td></tr></table>	Category	Percentage	PCT	39%	Not protected abroad	37%	Other	24%				
Category	Percentage												
PCT	39%												
Not protected abroad	37%												
Other	24%												
<p>A moderate proportion of triadic patents</p> <p>22% of OMRON HEALTHCARE's patent families were filed in Europe, the United States and Japan. They probably concern the company's best inventions.</p>	<p>Figure 18.3: Number of triadic patent families held by the three main players</p>  <table><tr><th>Company</th><th>Triadic families</th><th>Patent families</th></tr><tr><td>OMRON HEALTHCARE</td><td>110</td><td>~500</td></tr><tr><td>PHILIPS</td><td>332</td><td>~550</td></tr><tr><td>MEDTRONIC</td><td>37</td><td>~550</td></tr></table>	Company	Triadic families	Patent families	OMRON HEALTHCARE	110	~500	PHILIPS	332	~550	MEDTRONIC	37	~550
Company	Triadic families	Patent families											
OMRON HEALTHCARE	110	~500											
PHILIPS	332	~550											
MEDTRONIC	37	~550											
<p>The company rarely works with third parties and does not outsource its R&D activities.</p> <p>Relations between applicants are denoted by a blue line with the number of patent families in common.</p>	<p>Figure 18.4: Partnership networks</p> 												

Source: Clarivate Analytics - Data processed by INPI using Intellixir software (2016)

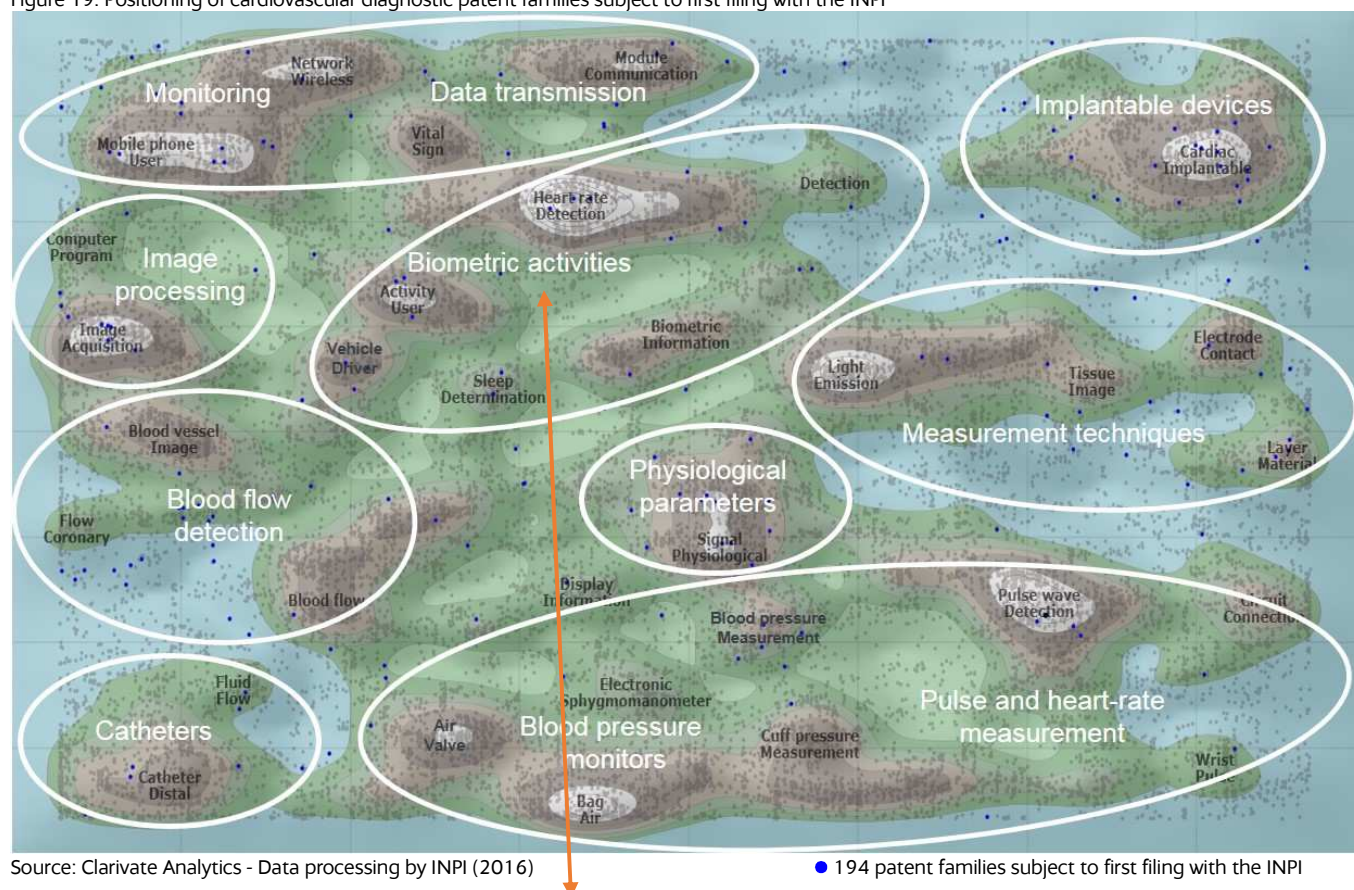
⁴¹ <https://www.omron.com/about/ir/irlib/pdfs/ar16e/ar2016e.pdf>

3. PATENT ANALYSIS IN FRANCE: 194 INVENTIONS OVER A PERIOD OF 15 YEARS

Is it possible to draw a map indicating one or several areas of technology particularly subject to filings with the INPI?

The inventions are evenly spread out across the nine main application areas. Over the 15-year period studied, we have identified **194** inventions, including applications made by French residents and applications made by foreign inventors wishing to obtain patent protection in France.

Figure 19: Positioning of cardiovascular diagnostic patent families subject to first filing with the INPI



The **French Centre for Space Studies (Centre national d'études spatiales, hereinafter the "CNES")** recently filed a patent application in the area of biometric activities.

Example 10:

Patent application no. FR3019029, filed by the **CNES** and published in 2015, describes a device for assisting the physical effort of a human and in particular to monitor and determine predictively physiological data without positioning data.

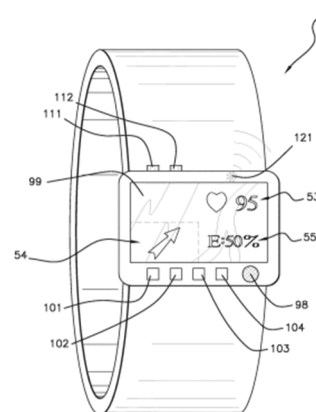


Fig. 1

3.1 WHICH PLAYERS FILE PATENTS IN FRANCE?

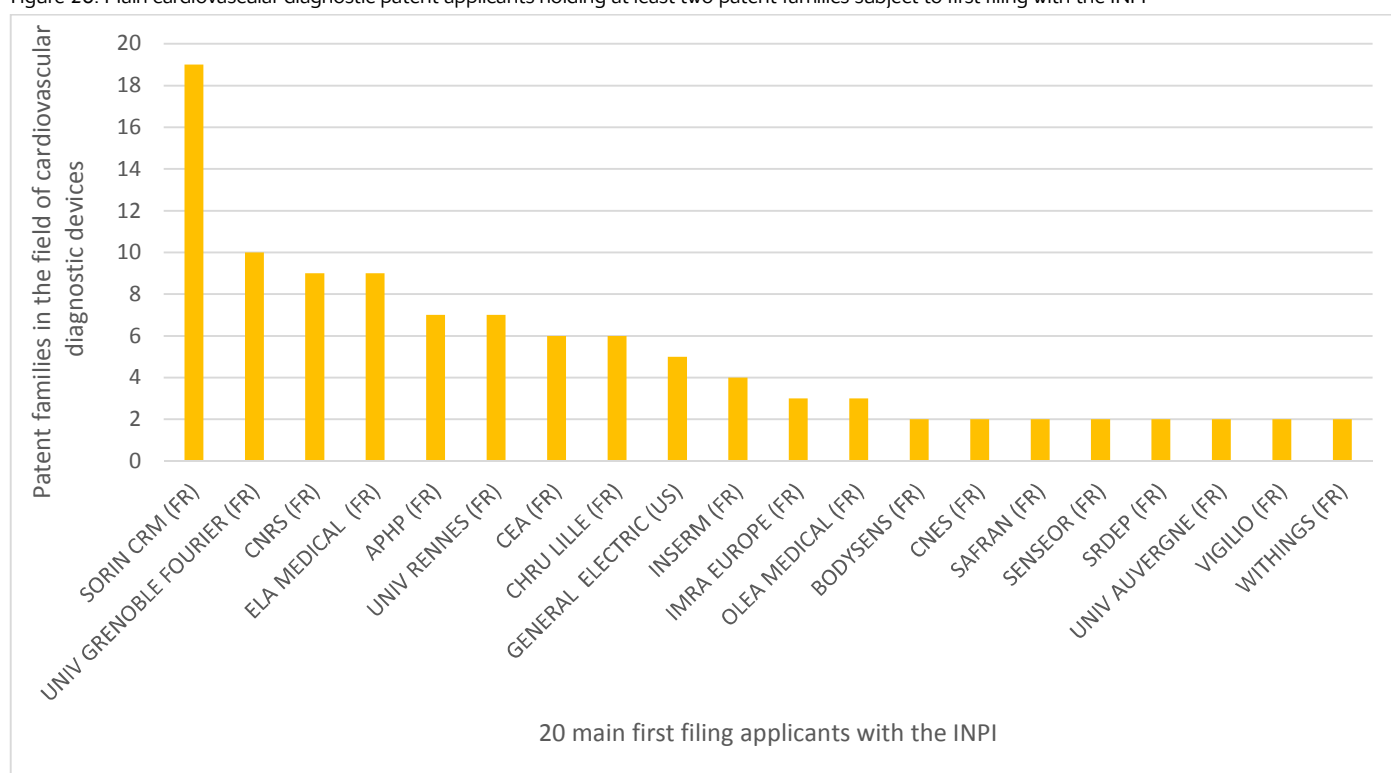
The majority of applications filed with the INPI in the field of cardiovascular diagnostic devices are made by French public research bodies.

Out of the 194 patent families subject to first filing in France⁴², 22% were filed by independent inventors.

Among the **20 main applicants** in the field of cardiovascular diagnostic devices, **9 are French public research bodies**.

They include three universities, the French Centre for Scientific Research (*Centre national de recherche scientifique* – **CNRS**), the Public Hospitals of Paris (*Assistance publique - Hôpitaux de Paris* – **APHP**), the French Atomic Energy Commission (*Commissariat à l'énergie atomique* – **CEA**), the Lille Regional University Hospital (*Centre hospitalier régional universitaire de Lille* – **CHRU LILLE**), the French Institute for Health and Medical Research (*Institut national de la santé et de la recherche médicale* – **INSERM**) and the **CNES**.

Figure 20: Main cardiovascular diagnostic patent applicants holding at least two patent families subject to first filing with the INPI



Source: Data processed by INPI using Intellixir software (2016) – the nationality indicated corresponds to the applicant's address at the time of filing.

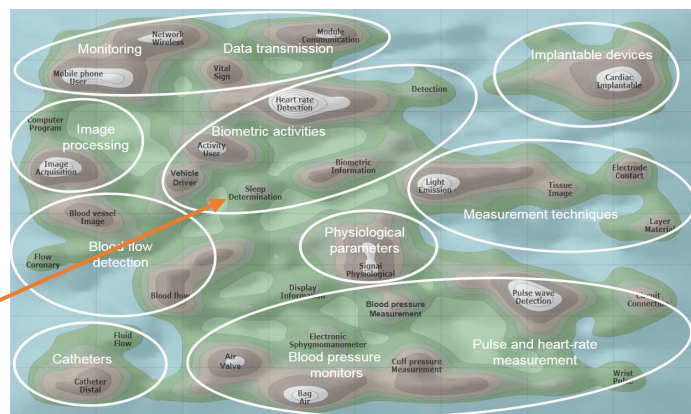
The leading company in France in terms of patent filings is **SORIN CRM**, the French subsidiary of the Italian group SORIN (the world leader in cardiovascular medical devices). 75% of medical technology produced by **SORIN CRM** in France is exported. **SORIN CRM** is the leading pacemaker manufacturer in France, is no. 2 in Japan and no.3 in Europe⁴³. It should be noted that SORIN acquired **ELA MEDICAL**⁴⁴ in 2001. In 2015, Italian group SORIN merged with US company CYBERONICS, which specialises in electrical nerve stimulation technology. Together they formed a new group, LIVANOVA, specialised in heart surgery and neurology. Its head office is based in the United Kingdom.

⁴² French applicants who filed a direct European or PCT application to obtain patent protection in France are not taken into account.

⁴³ <http://www.systematic-paris-region.org/en/members/livanova-ex-sorin-crm>

⁴⁴ https://fr.wikipedia.org/wiki/SORIN_Biomedica

SORIN CRM recently filed a patent in the area of biometric activities (“sleep determination”).



Example 11:

Patent application no. EP2904969, filed by **SORIN CRM (FR)**, published in 2015 and jointly filed with **INSERM, UNIVERSITÉ DE RENNES, and UNIVERSITÉ GRENOBLE FOURIER** describes a device for treating sleep apnea in a patient by kinaesthetic stimulation, with a view to stopping the apnea episode.

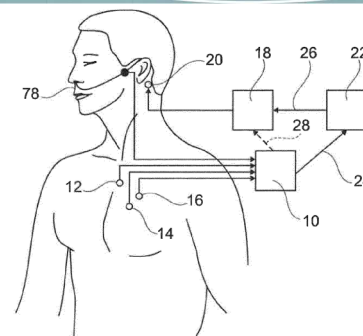
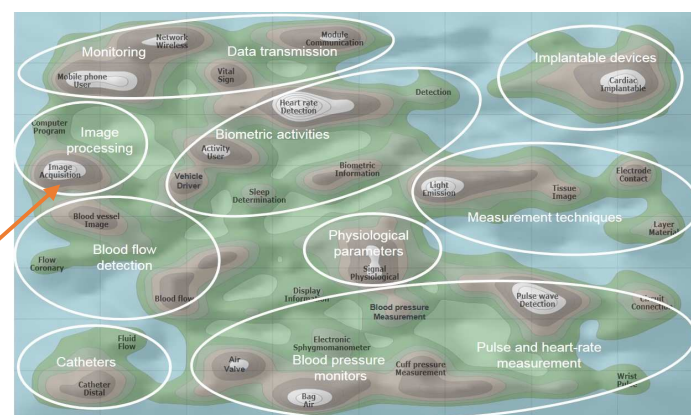


Fig. 2

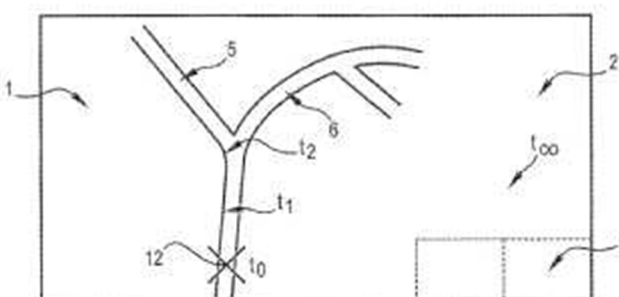
The presence of US giant **GENERAL ELECTRIC** is also of note. The group has been present in France⁴⁵ for over a century and the five patent applications filed were the work of French inventors.

One of **GENERAL ELECTRIC**'s inventions concerned the area of image processing (“image acquisition”).



Example 12:

Patent application no. FR2965085, filed by **GENERAL ELECTRIC (US)**, published in 2012 and issued on 26/06/2013, describes a method for processing an image (1) of a plurality of vessels (5) capable of propagating a fluid (6). This process makes it possible to improve knowledge of vessel mapping and propagation dynamics in the observed area.



⁴⁵ <http://www.ge.com/fr/company/ge-en-france> (in French)

3.2 HOW HAVE FILINGS CHANGED?

Three emerging SMEs have been identified following their patent applications filed between 2011 and 2013.

By analysing changes over time in the number of patent families held by the 20 main first filing applicants with the INPI, we can see which companies have filed recently.

Figure 21: Change over time in the number of patent families held by the 20 main first filing applicants with the INPI in the area of cardiovascular diagnostics

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
SORIN CRM	0	0	0	0	0	1	0	0	2	2	3	1	4	3	3	19
UNIV GRENOBLE FOURIER	0	0	0	0	0	0	1	1	1	1	0	2	0	1	3	10
CNRS	0	0	0	1	1	0	1	1	2	0	1	0	1	0	1	9
ELA MEDICAL	0	0	2	1	3	2	0	0	1	0	0	0	0	0	0	9
APHP	0	0	0	0	0	1	1	0	1	0	0	1	0	2	1	7
UNIV RENNES	1	0	0	0	0	0	0	1	1	0	0	0	0	0	4	7
CEA	0	0	0	3	0	0	1	1	0	0	1	0	0	0	0	6
CHRU LILLE	0	1	0	0	0	0	0	0	0	0	0	0	0	3	2	6
GENERAL ELECTRIC	0	0	0	0	1	1	0	1	0	0	2	0	0	0	0	5
INSERM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	4
IMRA EUROPE	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
OLEA MEDICAL	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	3
BODYSENS	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
CNES	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
SAFRAN	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
SENSEOR	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
SRDEP	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2
UNIV AUVERGNE	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
VIGILIO	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	2
WITHINGS	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2

Change over time in the number of patent families held by the 20 main first filing applicants with the INPI, by first priority date

Source: Data processed by INPI using Intellixir software (2016) – First priority year 2014 is dotted due to incomplete data.

This table shows the emergence of three new players:

- the start-up **WITHINGS** (see example 13), created in 2008⁴⁶. This French success story, specialising in connected objects for health and well-being, has just been acquired by Finnish giant **NOKIA**⁴⁷ ;
- **OLEA MEDICAL** (see example 14), created in 2008⁴⁸. This company, which operates in the field of medical imaging software, was bought out by Japanese company **TOSHIBA**⁴⁹ in 2015. In 2016, TOSHIBA sold its medical operations to fellow Japanese company **CANON**⁵⁰ ;
- and lastly, start-up **BODYSENS** (see example 15), created in 2009⁵¹. BODYSENS develops smart physiological sensors that collect the wearer's health data and send them to be analysed remotely. The company changed its name to **APPI-Technology**⁵² in 2016.

⁴⁶ <https://www.withings.com/eu/fr/>

⁴⁷ <http://www.usine-digitale.fr/editorial/le-rachat-par-NOKIA-valide-le-virage-b2b-de-WITHINGS.N388808> (in French)

⁴⁸ <http://www.olea-medical.com/en>

⁴⁹ <http://www.go-met.com/news/japonais-toshiba-rachete-olea-medical-basee-ciotat/> (in French)

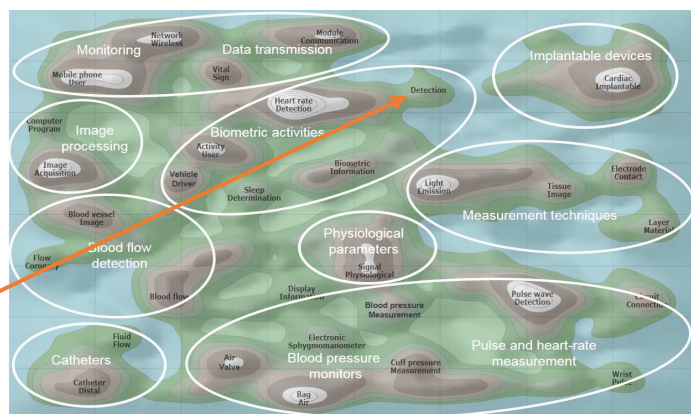
⁵⁰ <http://www.ladepeche.fr/article/2016/03/17/2305945-toshiba-confirme-vente-canon-activite-equipements-medicaux.html> (in French)

⁵¹ <http://www.bodysens.com/>

⁵² <http://appi-technology.com/appi-com-news-fr> (in French)

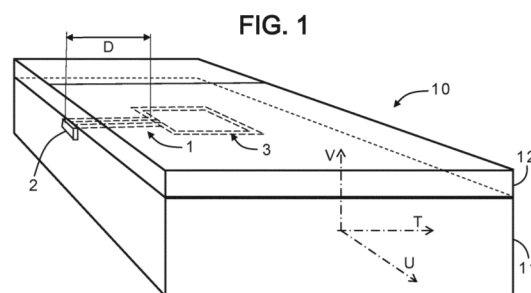
The patent applications listed below show the fields of activity of these three companies.

WITHINGS recently filed a patent in the area of biometric activities (“detection”).

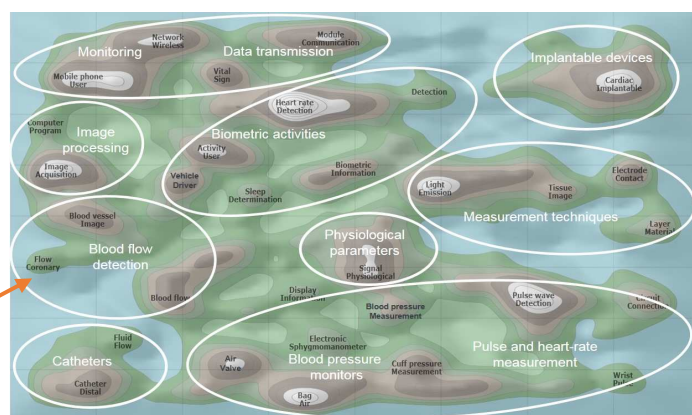


Example 13:

Patent application no. FR3013205, filed by **WITHINGS (FR)**, published in 2015 and issued on 09/12/2016, describes a detection device designed to be placed on or under a mattress, in order to detect, by ballistography, at least the movements, heart rate and respiratory rate of an individual lying on the mattress.

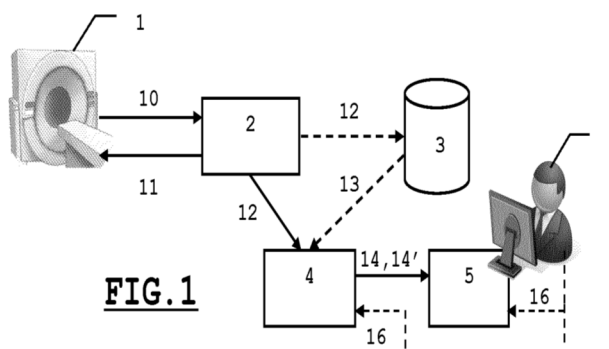


OLEA MEDICAL recently filed a patent in the area of blood flow detection (“coronary flow”).

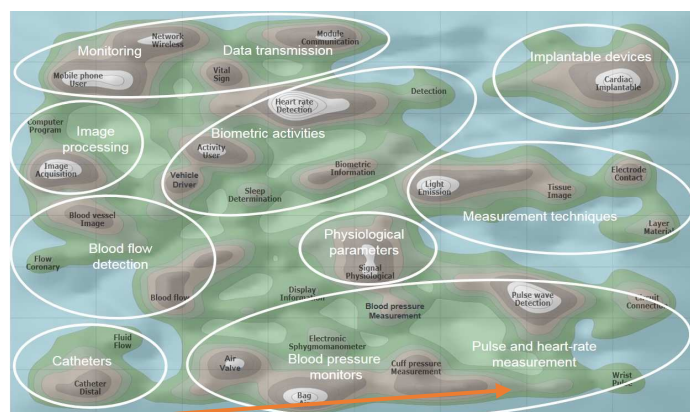


Example 14:

Patent application no. FR2996667, filed by **OLEA MEDICAL (FR)**, published in 2014 and issued on 11/12/2015, describes a method for the estimation of volume flows or plasma, interstitial or compound volumes relative to the flow of a contrast agent within an organ for diagnostic purposes.



BODYSENS recently filed a patent in the area of pulse and heart-rate measurement.



Example 15:
 Patent application no. FR2998158, filed by **BODYSENS (FR)**, published in 2014, issued on 08/01/2016 and jointly filed with **CHU NÎMES**, describes a method and device for the remote monitoring of patients, in particular newborns and children. Instrumented clothing with physiological data sensors are used to remotely monitor physiological and health data, in addition to environmental data.

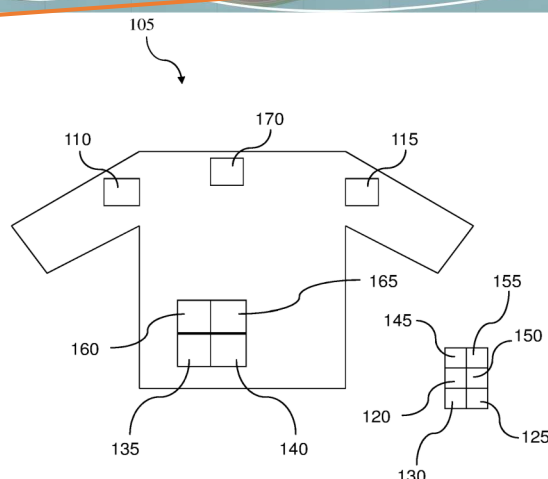


Figure 1

In addition to the companies already mentioned, the following SMEs are also of note:

IMRA EUROPE⁵³, an SME and subsidiary of Japanese group AISIN, created in 1986. This company is specialised in monitoring the biological parameters of vehicle drivers.

French SME **SENSEOR**⁵⁴, created in 2006 and specialising in wireless and passive sensors. It was absorbed by German group WIKA in 2012.

SRDEP⁵⁵, a resource and development firm for companies and individuals created in 2008. It specialises in research and development in the area of natural and physical sciences.

And lastly **VIGILIO**⁵⁶, a company created in 2005, which designs, develops and sells smart biosensors and telemedical solutions.

Most of the French start-ups identified have been bought out by foreign groups over the past few years.

⁵³ <http://www.imra-europe.com/#/whoweare/aisingroup>

⁵⁴ <http://www.senseor.com/>

⁵⁵ <https://clubstersante.com/membre-cs/srdep-societe-de-ressources-et-de-developpement-pour-les-entreprises-et-les-particuliers/> (in French)

⁵⁶ <http://www.vigilio.fr/> (in French)

3.3 WHAT PARTNERSHIPS HAVE BEEN IDENTIFIED AS A RESULT OF JOINT FILINGS?

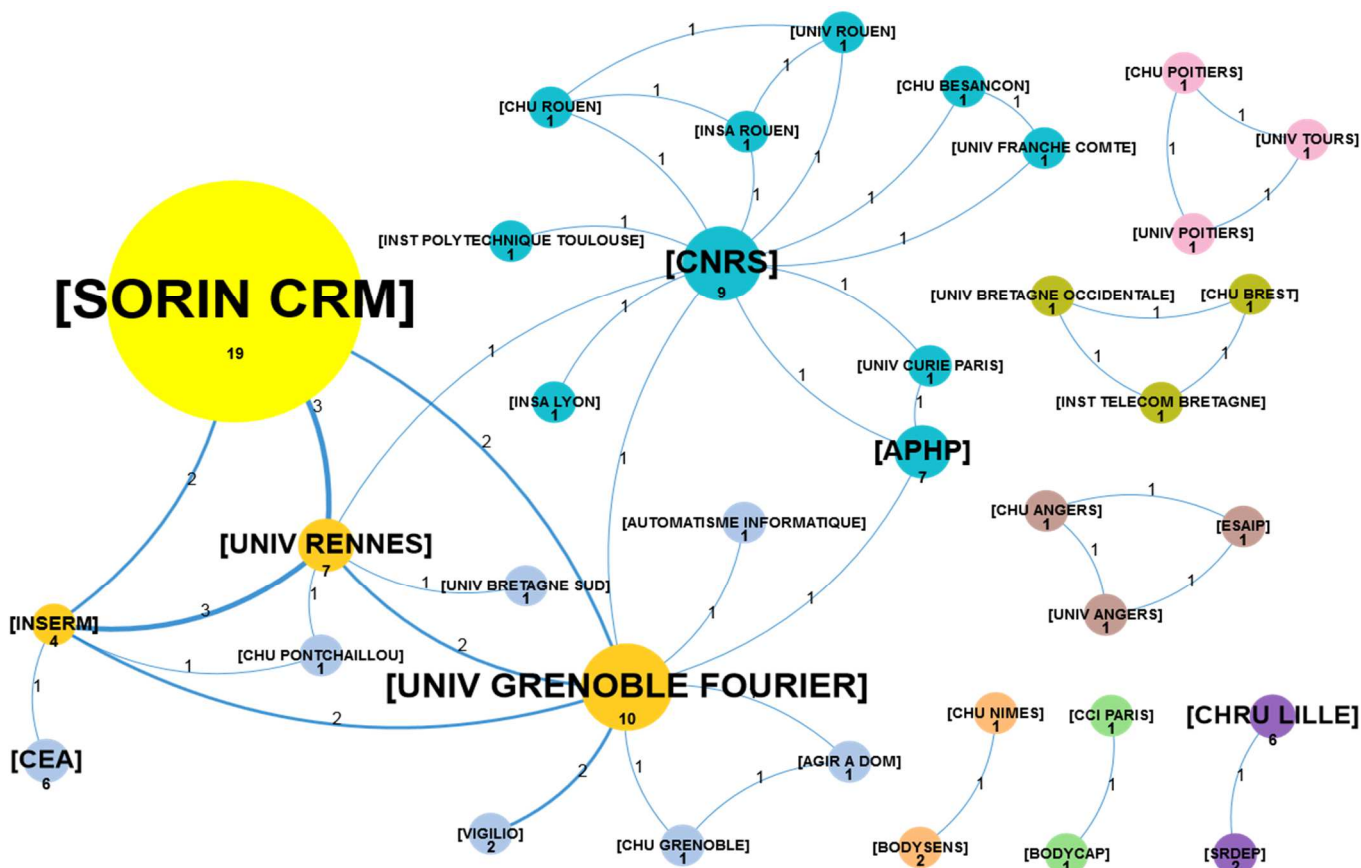
In France, there is a considerable partnership network between both universities, schools and regional hospitals, and between companies and French public research bodies.

By analysing the partnership network between first filing applicants with the INPI, we were able to identify research and development partnerships.

Among the main companies identified in the field, four have partnerships with French public bodies: **SORIN CRM**, **BODYSENS**, **SRDEP** and **VIGILIO**. The others—**ELA MEDICAL**, **GENERAL ELECTRIC (US)**, **IMRA EUROPE**, **OLEA MEDICAL**, **SAFRAN**, **SENSEOR** and **WITHINGS**—have filed individually and do not feature on the diagram below (see Figure 20).

The size of the circles is proportional to the number of patent families held. Relations between the applicants are denoted by a blue line with the number of patent families in common. The colours make it easier to see where the various partnerships lie.

Figure 22: Partnership networks between first filing applicants with the INPI, in the field of cardiovascular diagnostic devices, with their respective number of patent families and the number of joint filing



Partnership networks between first filing applicants with the INPI

Source: Data processed by INPI using Intellixir software (2016)

SORIN CRM filed three patent families with **UNIVERSITÉ DE RENNES**, including two which were also filed with **UNIVERSITÉ DE GRENOBLE** and **INSERM** (see example 11).

BODYSENS jointly owns a patent with **CHU NÎMES** (see example 15).

SRDEP jointly filed a patent with the **CHRU LILLE**.

Lastly, the two patent applications made by **VIGILIO** were jointly filed with **UNIVERSITÉ DE GRENOBLE**.

French inventions in this field are therefore often the result of close collaboration between the university networks, research bodies and partner companies.

CONCLUSION

This study on patents in the field of cardiovascular diagnostic devices highlights the main players, the different technology involved, and the geographic and temporal distribution of inventions both in France and worldwide.

Mapping is used to portray the technology identified and grouped in this field, the positioning of market players and the countries of origin of the inventions.

We examined a period of 15 years (from 01/07/1999 to 30/06/2014) and a total of 84,618 patent applications, representing 27,552 inventions from 59 patent offices. On a global level, we can see a sharp increase in patent applications from 2000 to 2013 in the field of cardiovascular diagnostic devices. Mapping allowed us to track the technological changes in this sector by analysing the nine key fields of technology and applications. The trend is clearly shifting towards connected devices that allow for better health and well-being monitoring. The following examples highlight this trend: connected beds, smart clothing, bracelets for tracking biometric activity, as well as warning devices to signal irregular physiological readings. All of this new technology helps patients to monitor their own health by means of indicators, but can also help provide earlier diagnosis, thus enhancing the prevention of CVDs.

Over the period in question, patent applications were mainly filed in the United States, China and Japan. Of the 15 main applicants, 7 were of Asian origin, 5 were from the US and 3 were from Europe. Three companies were identified as having a portfolio of at least 500 patent families: US company MEDTRONIC, Dutch company PHILIPS and Japanese company OMRON HEALTHCARE.

Among the 20 main applicants in France, 9 were public research bodies, some of which jointly filed applications with small French companies such as BODYSENS. The main applicant was SORIN CRM, a subsidiary of Italian group SORIN specialised in diagnosing and treating cardiac arrhythmia. It filed applications with public bodies such as INSERM, UNIVERSITÉ DE RENNES and UNIVERSITÉ DE GRENOBLE.

This study also highlights two innovative French companies, WITHINGS and OLEA MEDICAL, whose potential has been recognised internationally, resulting in their acquisition by major companies. WITHINGS was acquired by NOKIA, whereas OLEA MEDICAL was acquired by TOSHIBA.

There is a considerable partnership network between universities, schools and regional hospitals, which are very involved in this field, and between companies and French public research bodies.

This economic sector is constantly evolving due to a high number of mergers and acquisitions, both in France and abroad: of particular note is the acquisition of French innovative technology start-ups by foreign companies.

According to Berg Insight, at end-2013 approximately 3 million patients used home health monitoring devices prescribed by health professionals. The market research firm estimates that this figure will increase sixfold to over 19 million by 2018, representing an annual growth rate⁵⁷ of 44.4%. Connected objects are on the verge of revolutionising our health and taking over our daily lives. We can expect plenty more inventions in this field, and new patent applications as a result.

⁵⁷ <https://www.conseil-national.medecin.fr/sites/default/files/medecins-sante-connectee.pdf> (in French)

APPENDICES

APPENDIX 1: PROSPECTIVE ANALYSIS OF DATA RELATING TO MEDICAL TECHNOLOGY

Since 1975, patents have benefited from a very detailed technological classification, which is used by all countries in their patent system: the International Patent Classification⁵⁸ (IPC). The IPC has a hierarchical structure which divides technology into eight main sections, which are then subdivided. The IPC labels are allocated by the national or regional office of industrial property which publishes the patent document.

The IPC is very useful for searching for patent documents as part of research on prior art.

The IPC sub-classes used for the prospective analysis of medical technology are defined in the table below:

A61B	DIAGNOSIS; SURGERY; IDENTIFICATION
A61C	DENTISTRY; APPARATUS OR METHODS FOR ORAL OR DENTAL HYGIENE
A61D	VETERINARY INSTRUMENTS, IMPLEMENTS, TOOLS, OR METHODS
A61F	FILTERS IMPLANTABLE INTO BLOOD VESSELS; PROSTHESES; DEVICES PROVIDING PATENCY TO, OR PREVENTING COLLAPSING OF, TUBULAR STRUCTURES OF THE BODY, E.G. STENTS; ORTHOPAEDIC, NURSING OR CONTRACEPTIVE DEVICES; FOMENTATION; TREATMENT OR PROTECTION OF EYES OR EARS; BANDAGES, DRESSINGS OR ABSORBENT PADS; FIRST-AID KITS
A61G	TRANSPORT, PERSONAL CONVEYANCES, OR ACCOMMODATION SPECIALLY ADAPTED FOR PATIENTS OR DISABLED PERSONS; OPERATING TABLES OR CHAIRS; CHAIRS FOR DENTISTRY; FUNERAL DEVICES
A61H	PHYSICAL THERAPY APPARATUS, e.g. DEVICES FOR LOCATING OR STIMULATING REFLEX POINTS IN THE BODY; ARTIFICIAL RESPIRATION; MASSAGE; BATHING DEVICES FOR SPECIAL THERAPEUTIC OR HYGIENIC PURPOSES OR SPECIFIC PARTS OF THE BODY
A61J	CONTAINERS SPECIALLY ADAPTED FOR MEDICAL OR PHARMACEUTICAL PURPOSES; DEVICES OR METHODS SPECIALLY ADAPTED FOR BRINGING PHARMACEUTICAL PRODUCTS INTO PARTICULAR PHYSICAL OR ADMINISTERING FORMS; DEVICES FOR ADMINISTERING FOOD OR MEDICINES ORALLY; BABY COMFORTERS; DEVICES FOR RECEIVING SPITTLE
A61L	METHODS OR APPARATUS FOR STERILISING MATERIALS OR OBJECTS IN GENERAL; DISINFECTION, STERILISATION, OR DEODORISATION OF AIR; CHEMICAL ASPECTS OF BANDAGES, DRESSINGS, ABSORBENT PADS, OR SURGICAL ARTICLES; MATERIALS FOR BANDAGES, DRESSINGS, ABSORBENT PADS, OR SURGICAL ARTICLES
A61M	DEVICES FOR INTRODUCING MEDIA INTO, OR ONTO, THE BODY; DEVICES FOR TRANSDUCING BODY MEDIA OR FOR TAKING MEDIA FROM THE BODY; DEVICES FOR PRODUCING OR ENDING SLEEP OR STUPOR
A61N	ELECTROTHERAPY; MAGNETOTHERAPY; RADIATION THERAPY; ULTRASOUND THERAPY
H05G	X-RAY TECHNIQUE

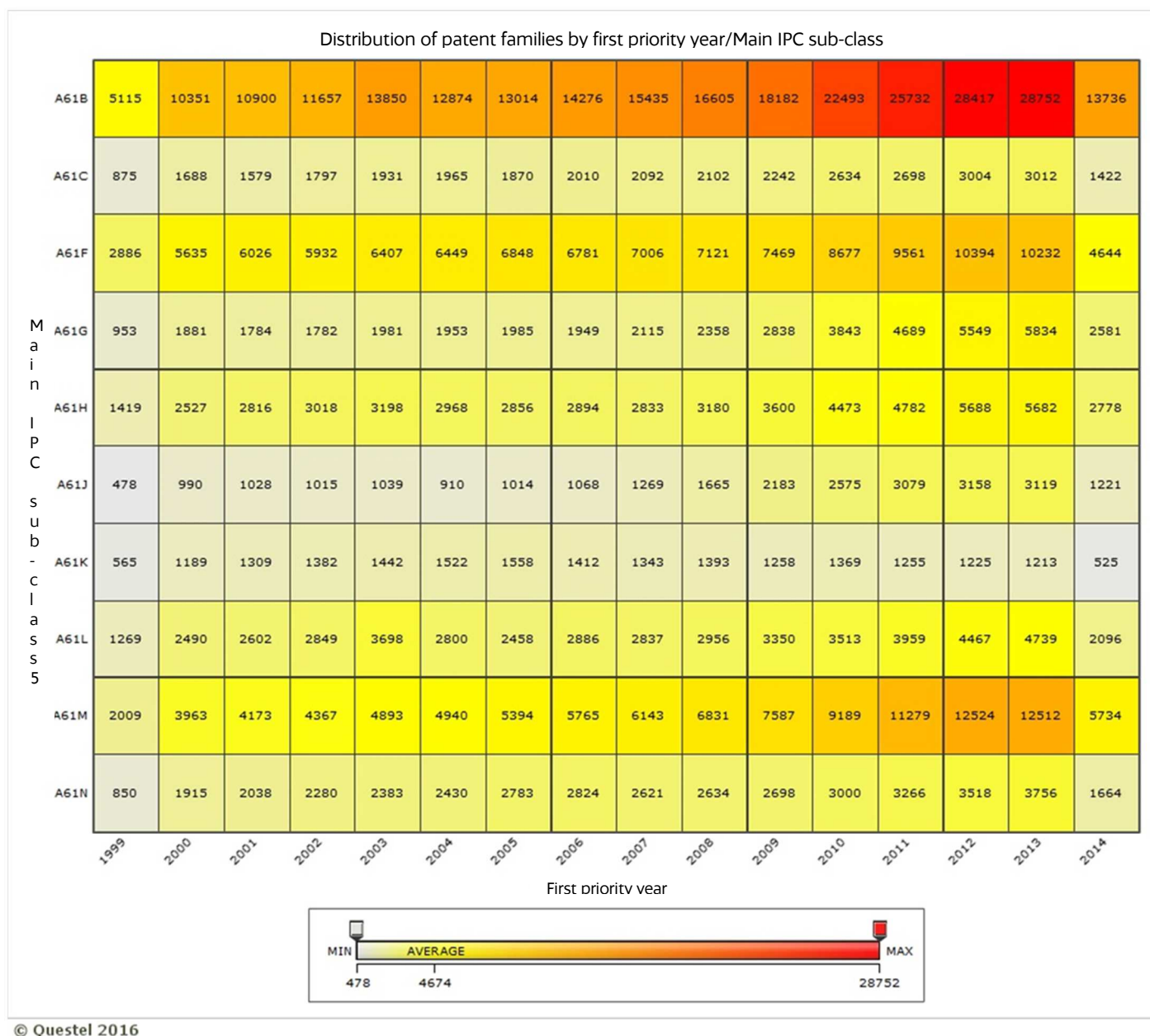
In the field of medical technology, over the 15-year period studied, at 13/06/2016 the number of DWPI families (see Appendix 2) with a first priority date between July 1999 and June 2014 was 923,489. Sub-class A61B⁵⁹, which covers diagnosis, surgery and identification represents, roughly 41% in the field of medical technology.

⁵⁸ <http://web2.wipo.int/classifications/ipc/ipcpub/#lang=fr&menulang=FR&refresh=fipcp&fipcp=yes>

⁵⁹ <http://web2.wipo.int/classifications/ipc/ipcpub/#lang=fr&menulang=FR&refresh=fipcp¬ion=scheme&version=20160101&symbol=A61B&fipcp=yes>

The rate of filing over the 15 years examined is outlined below and was established using the QUESTEL-ORBIT analysis software based on FAMPAT⁶⁰ data.

Figure 23: Trend observed among the 10 main sub-classes of the International Patent Classification (IPC) in the field of medical technology



Based on a series of studies on the distribution of the number of patent families by first priority year in accordance with the IPC, cardiovascular diagnostic devices belonging to sub-group A61B-005/02 have been shown to be particularly innovative.

⁶⁰ The database used is FAMPAT, a worldwide collection of patents grouped by invention-based families containing bibliographic information and the full text.

A patent family is comprised of a set of documents published by close to one hundred industrial property offices. Each reference groups the different stages of publication of all members of the family. Questel has developed a definition of the family that combines the strict EPO family rule with additional rules, making it possible to take into account the links with the parent European patent (EP) and/or international patent (WO) applications, as well as links between US provisional applications and published US applications.

APPENDIX 2: METHODOLOGY USED FOR CARDIOVASCULAR DIAGNOSTIC DEVICES

This study takes into account patent families, i.e. all patents or patent applications filed and published in several countries, which have a link with each other due to one or several priority applications in common. A patent family is considered to group all patents protecting the same invention. The Organisation for Economic Co-operation and Development (OECD) has established a new type of indicator based on counting by patent family. The use of indicators based on patent families represents two advantages: improved comparability by eliminating home advantage bias and the influence of geographical location, and the grouping of high-value patents⁶¹.

Data relating to patents make it possible to carry out an analysis using several classifications, such as the IPC⁶² and the Cooperative Patent Classification (CPC)⁶³.

Database used in this study

We used Clarivate Analytics' Derwent World Patent Index (DWPI), along with the Derwent Innovation tool, to carry out mapping and to group the main applicants together.

Clarivate Analytics patent data are imported into the Intellixir⁶⁴ patent analysis software in order to create graphs.

The DWPI database is a global collection of patents from 50 industrial property offices and representing approximately 65 million patents grouped in families (31 December 2015). The Derwent family compiles patents covering the same invention. Their relationship is defined by the priority or filing details claimed by each document: documents with at least one priority in common belong to the same family of documents.

Strategy used to submit queries in the field of cardiovascular diagnostic devices

In order to query the DWPI database, the general strategy used is:

AIC=(A61B000502*) AND (PRD>=(19990701) AND PRD<=(20140630))

On a global scale, over a filing period of 15 years, **84,618 patent publications** were identified in the field of cardiovascular diagnostic devices. They are grouped into **27,552 inventions** (Derwent patent families) from **59** patent offices⁶⁵. These 27,552 inventions represent **3% of medical technology inventions**.

⁶¹ Source: OECD

⁶² <http://web2.wipo.int/classifications/ipc/ipcpub/#lang=fr&menulang=FR&refresh=fipcp&fipcp=yes>

⁶³ https://worldwide.espacenet.com/classification?locale=fr_EP

⁶⁴ <http://www.intellixir.com/>

⁶⁵ See appendix 4

Definition of the IPC sub-group in the field of cardiovascular diagnostics (A61B5/02)

A61B5/02	MEASURING PULSE, HEART RATE, BLOOD PRESSURE OR BLOOD FLOW; COMBINED PULSE/HEART-RATE/BLOOD PRESSURE DETERMINATION; EVALUATING A CARDIOVASCULAR CONDITION NOT OTHERWISE PROVIDED FOR, E.G. USING COMBINATIONS OF TECHNIQUES PROVIDED FOR IN THIS GROUP WITH ELECTROCARDIOGRAPHY; HEART CATHETERS FOR MEASURING BLOOD PRESSURE
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Strategy used to submit queries regarding triadic patents

Counting of triadic patents (see Appendix 3) was carried out on the publications present in the DWPI family.

The 27,552 DWPI patent families were integrated into the Intellixir tool before being filtered in order to obtain the number of triadic families with a European patent (EP), a Japanese patent (JP) and an American patent (US). The number of triadic families was 3,101.

We were thus able to obtain the number of triadic families for each of the 15 main applicants outlined in this study.

APPENDIX 3: ACRONYMS AND DEFINITIONS

Main acronyms used

CPC: Cooperative Patent Classification
CVDs: Cardiovascular diseases
DPMA: German Patent Office (*Deutsches Patent- und Markenamt*)
DWPI: Derwent World Patent Index
EPO: European Patent Office
INPI: French Patent and Trademark Office
IPC: International Patent Classification
JPO: Japan Patent Office
KIPO: Korean Intellectual Property Office
OECD: Organisation for Economic Co-operation and Development
PCT: Patent Cooperation Treaty
R&D: Research and Development
SIPO: State Intellectual Property Office (Chinese Office)
USPTO: United States Patent and Trademark Office
WHO: World Health Organization
WIPO: World Intellectual Property Organization

Chinese utility model patent

Utility model patents are issued for a maximum duration of 10 years from the date of filing and are traditionally used in China as they are quick and easy to obtain. They are relatively cheap compared to standard invention patents and protect new products that feature a clear form of technological innovation. This type of patent is extremely successful in China.

Triadic patent

Triadic patent families are defined as those patents applied for at the three main intellectual property offices worldwide, i.e. the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO), to protect a same invention. Triadic patents eliminate biases arising from home advantage and the influence of geographical location. These patent families have a high value. The holders of this type of patent portfolio incur additional costs and accept the time involved in obtaining protection abroad when they deem it necessary.

Patent applicants

Patent applicants include French or foreign legal entities (companies, universities, research bodies and other public establishments, associations and foundations), as well as natural persons who have filed at least one patent application.

APPENDIX 4: THE MAIN FILING COUNTRIES

DWPI first priority country ⁶⁶	Number of documents	Percentage
US	11,103	40.30%
CN	4,862	17.65%
JP	4,746	17.23%
KR	1,189	4.32%
DE	1,133	4.11%
RU	1,070	3.88%
TW	791	2.87%
EP	539	1.96%
WO	483	1.75%
GB	308	1.12%
FR	194	0.70%
AU	151	0.55%
FI	136	0.49%
SE	116	0.42%
IT	76	0.28%
IL	60	0.22%
IN	56	0.20%
ES	53	0.19%
CA	47	0.17%
NL	43	0.16%
AT	40	0.15%
DK	40	0.15%
PL	40	0.15%
BR	38	0.14%
CH	30	0.11%
SG	28	0.10%
CZ	27	0.10%
ZA	16	0.06%
MX	16	0.06%
HU	14	0.05%
NO	12	0.04%
NZ	12	0.04%
IE	10	0.04%
RO	9	0.03%
BE	8	0.03%
TR	7	0.03%
MY	6	0.02%
UA	5	0.02%
AR	4	0.01%
HK	4	0.01%
PT	4	0.01%
IS	3	0.01%
RS	3	0.01%
LV	2	0.01%
LU	2	0.01%
EE	2	0.01%
CO	2	0.01%
PK	1	0.00%
LB	1	0.00%
SA	1	0.00%
AE	1	0.00%
MA	1	0.00%
UZ	1	0.00%
UY	1	0.00%
GR	1	0.00%
VN	1	0.00%
ID	1	0.00%
PH	1	0.00%
SK	1	0.00%

⁶⁶ <http://www.wipo.int/export/sites/www/standards/en/pdf/03-03-01.pdf>

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