TECHNOLOGY
WATCH REPORT

Product innovation in Cosmetics

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TECHNOLOGY WATCH REPORT

Product innovation in Cosmetics

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1
Overview of innovation and tendencies in Cosmetic Products

Perfumery and cosmetics grew by 2.15% in Spain during 2017 in all five product categories covered by the sector (perfumes and fragrances; colour cosmetics; skin care; hair care and personal hygiene), reaching a consumption of 6,820 million Euros. The mean spending per Spanish individual on cosmetic products is above the European average by almost 150 € / year. The data available show that it is a **mature, solid sector** with a special commitment to **internationalisation**: Spain is ranked among the World's Top 10 Exporters of beauty products, with annual rates of close to 10%, led by perfumes, a subsector where Spain is considered the 4th largest exporter in the world.

Here are the figures for a sector that maintains an attitude of continued improvement: In Spain, 25% of the cosmetic products on the market are reformulated each year, and approximately 10% of these incorporate new ingredients. In this industry, and others, innovation is based on the changing **preferences of consumers** for active ingredients, textures, formats and fragrances, as well as by research into new niche markets. The key to the innovation of cosmetic products is in the laboratory, and the greatest technical challenges apart from the quality of the ingredients are the **consistency** and **stability** provided by the formulations and packaging. These challenges are quite apart from those related to evidence-based **safety** and **efficacy**.

"High awareness among consumers, a growing middle class, an aging population, and new markets such as men's grooming, Halal Beauty, and bio-based skin care have created a wide range of opportunities for active ingredient manufacturers"

It is well-known that all cosmetics are made up of the classes of ingredients:

- **excipient,** comprised of water and oil, that enables the skin to absorb the active ingredients.
- **active ingredients**, that is, the substances that ensure the efficacy of the product.
- and finally **additives** to emulsify, stabilise, provide colour, preserve and perfume the product.

In particular the **global market for personal care active ingredients** was estimated at 3.5 thousand million dollars in 2016 and is expected to reach 5.6 thousand million by 2023, **growing at an annual rate of 7.0%** during this period.

On the world stage, the expected behaviour of the various active ingredients is:

- **moisturising ingredients:** even though glycerol is the most often used and most economic ingredient, its market share is expected to drop slightly, being replaced by pyrrolidone carboxylic acid (PCA), hyaluronic acid, amino acids and ceramides are also relevant.

- **anti-ageing ingredients:** whereas vitamin A and its derivatives represent the majority of the market, vitamin E and its derivatives are the segment with greatest growth. Vitamin C and derivatives are also present; Vitamin B3 and Derivatives; CoQ10; Collagen and plant extracts.
- **UV filters:** increasing consumer awareness on sunscreen products and an expanding market for advanced products boost the unit shipment growth of this market.
- **exfoliant ingredients:** exfoliating ingredients will record a negative growth rate, which is proportional to the rising consumer awareness on the harmful effects of skin etching. Glycolic acid will continue to dominate the segment and is expected to remain the most significant and dominant sub-segment during the forecast period.
- **antimicrobial ingredients:** in 2016, the USFDA and the EU banned triclosan and triclocarban, which resulted in a slowdown of the growth of average prices. As ingredients active against infections such as acne, pimples, and rashes are considered as effective, the unit shipment volume is expected to grow.
- **other ingredients:** there is a growing market for skin whitening and contraceptive products.

The heightened awareness of consumers about the advantages of active ingredients constantly encourages manufacturers **to compensate for restrictive barriers** such as more and more stringent legislation in North-America and Europe, the growing competition of informal markets and a market sensitive to high prices.

"To date the bioactive market has been mainly concentrated in the United States and the European Union but is expected to shift toward Asia Pacific "

Whereas conventional cosmetics use natural and synthesised active ingredients, in bio cosmetics the active ingredients are of vegetable and, preferably, biological origin. To date the bioactive market has been mainly concentrated in the United States and the European Union but is expected to shift toward Asia Pacific because of growing economies, a favourable regulatory environment, increased population, and consumer awareness.

The use of **bioactives** in various personal care products is an emerging trend and a competitive market associated with certain **guidelines for innovation**:

- Some bioactive or phytochemical compounds are found at very low concentrations in nature and so immense harvesting is needed, and their structural diversity and complexity often make chemical synthesis non-profitable. In conventional **bioactive plant extraction** methods, botanical extracts are isolated from dried plants using chemical solvents as separation media. This results in plant cell degradation that enables only a narrow band of ingredients to be extracted and leads to a host of other limitations. Innovative extraction technologies selectively isolate intracellular components from living plants and marine sources to produce a much wider range of bioactive cosmetic ingredients that are able to capture the powerful synergy that exists within the biological cells.
- The **formulation** of products by increasing the natural and organic ingredients in their composition is also particularly complex, because the physiochemical behaviour and properties of bioactive ingredients can affect the odour, colour, safety, cost and most importantly, the **stability and preservation** of the final products. Both ingredient

suppliers and personal care product manufacturers have been seeking solutions by utilizing advanced equipments and solutions to detect and improve the rheological behaviour of the formulation.

- The specific technologies are delivery systems that aim to transport bioactive ingredients into the targeted area or body part, increasing the bioavailability and stability of the bioactives, and allowing their controlled release from formulations. **Encapsulation and emulsion** technologies at micro and nano levels are being researched to improve target delivery systems and enhance the effect of bioactive ingredients. The **perceptible sensorial effects**, such as texture and fragrance, are also important. This means that micro-encapsulation technology becomes necessary not only for the protection and controlled release of the active ingredients, but also to maintain the additives of the cosmetics for a longer period of time.
- The difficulties inherent to the detection, extraction, formulation and release of these compounds are further complicated by other challenges such as the problems of **biocompatibility** and the growing need to demonstrate product **efficacy**. Even though the majority of bioactive ingredients derived from natural resources are considerably less toxic and have fewer negative secondary effects, suppliers provide material safety data and ex-vivo tissue models to confirm the **safety profile** of the ingredients and the formulations.

- The bioactive market has driven the development of **advanced technologies**. It is heavily dependent on innovations in strategic, technical and marketing concepts. The tendencies in this field, some of which have been briefly mentioned above, are:

- **Living cells are being researched** as ingredients to increase the bioactive effect, including stem cells and algae. Stem-cell based technologies have had a major impact across the medical community and the presence of these stem-cell skin cosmetic products is also rather substantial. When considering stem cell technologies in this, not always regulated, industry the rules governing the internal clinical trials carried out gain importance.
- **Design of nano-ingredients**. Nanoparticles and liposomes acting as vehicles for delivery of bioactive ingredients.
- **Development of bioactive mixtures** and extraction technologies for hair care, anti-ageing, UV-free tanning, baby care, slimming, and several other segments of the personal care industry.

In a context of a ban on animal testing to determine the toxicity of cosmetic products in some countries, as well as inadequate regulations in others, **technological innovations are the key to increasing market share and obtaining a competitive advantage** focussed on improving functionality and safety, not only in the field of bioactive producers, but that of all active ingredients

The cosmetic industry pushes the frontiers of innovation by adopting emerging technologies previously not close to being considered in the field of personal care. Involving customers and providing them with added value in the cosmetic purchase process is becoming more and more normal in this industrial environment. The cosmetics industry has been trying to restructure

and rebrand its capabilities by adopting a range of different **emerging technologies** in addition to those already mentioned, including:

"The cosmetic industry pushes the frontiers of innovation by adopting emerging technologies previously not close to being considered in the field of personal care"

- **3D Bioprinting:** With high profile alliances for the development of tissue models similar to the skin to perform aesthetic testing, there is a growing number of cosmetic companies focussed on offering personalised make-up products using 3D printing technologies. The affordability of materials, the printing capability using multiple materials, the throughput performance of the printers, as well as whether the printers will comply with the required GMP regulations, all need to be ensured to assess the pertinence of these technologies.
- **Genetic Personalisation:** With the increased awareness that genetics has brought to the medical field, it is highly possible that genetic testing methodology can help assess an individual's skin and provide them with valuable information, improving their purchasing choices. The interest of these genetic tests would not only be for the consumer; other businesses, especially cosmeceutical companies, would benefit by the information that they gather from their customers genetic profiles and rebrand their products toward the target demographics.
- **Virtual reality and IoT:** Technologies based on virtual reality and Internet of Things (IoT) are expected to have more and more impact on the cosmetic industry due to the proliferation of digital media among consumers. On-line advertising and marketing are in addition to the contents of social networks, mobile personalisation applications, various examples of interconnected skin care devices, reality virtual, augmented reality and IoT. These highly complex and sophisticated technologies have a major impact across various verticals and their adoption is the best way to improve marketing strategies to boost consumer experience.

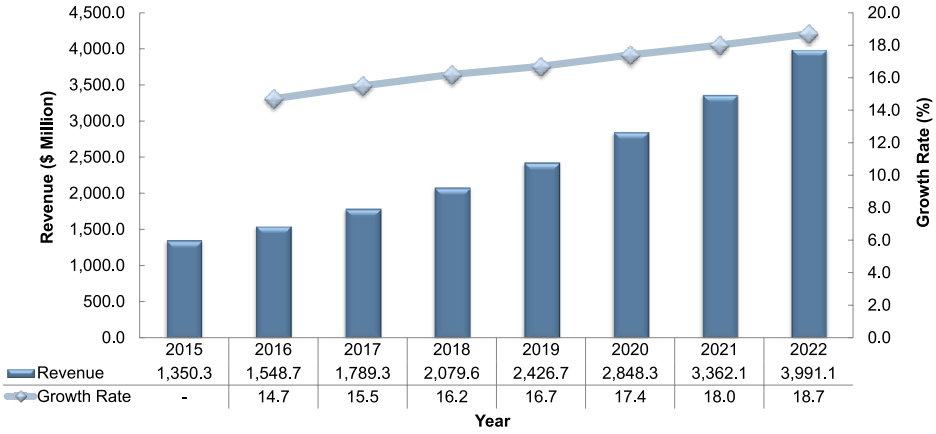
These emerging technologies are the focus of research and development because, as has occurred in other industrial segments, they open up new business models and contribute to widening the consumer base of the main cosmetic developers, influencing their procedures and products.

The constant growth of the convergence in the cosmetics industry indicates a positive change towards greater **personalisation** and more product **quality**, but also towards the strict **ethics** often imposed by the certification of product sustainability and processes. **Packaging** with biodegradable materials is the final consequence of this tendency, even though innovation in containers also seeks more comfortable, lighter, attractive and easy-to-use formats.

In short, cosmetics consumers demand **multifunctional natural products** that are **effective**, **sustainable and safe**, developed using chic austerity logic (quality/**price** ratio) and **multi-target**, that consider adapting to ethnic minorities, and other groups such as homosexuals, preadolescents and adolescents, and the over 60's.

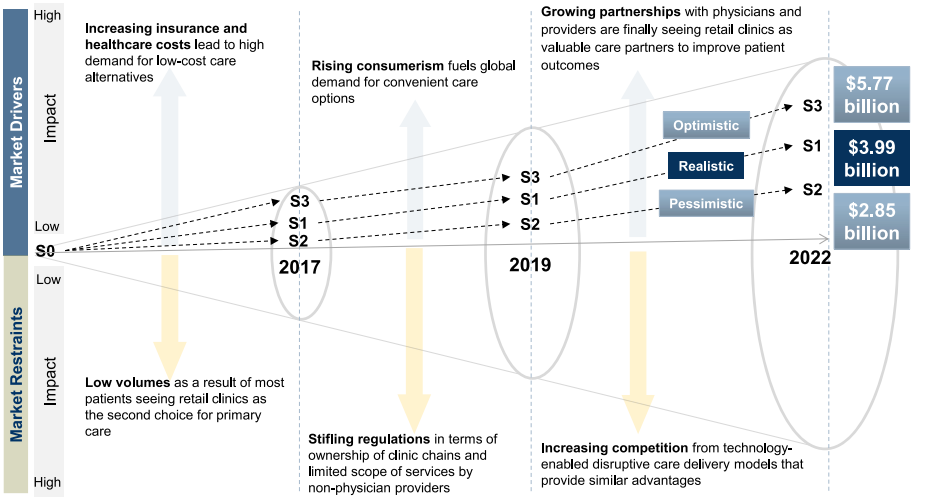
2
Personal Care Markets, Ingredients and Technologies: Key Infographs

2.1. Healthcare Market: Revenue Forecast (2015-2022)



Source: Frost & Sullivan (2016). Future of Global Retail Healthcare Delivery Markets, Forecast to 2022

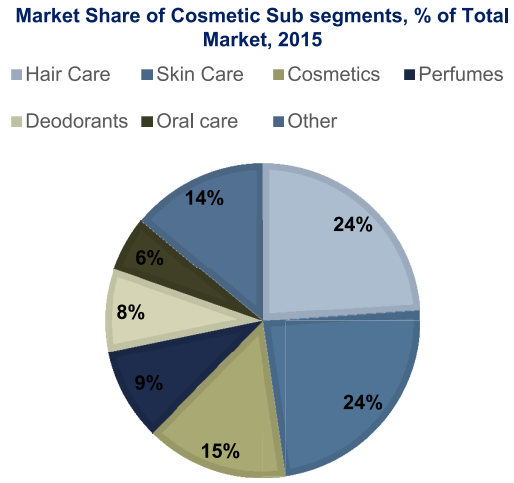
2.2. Healthcare Market: Scenario Analysis (2015-2022)



Note: All drivers and restraints are denoted for time periods when they are likely to be most important, although their impact will be observed for the entire forecast period.

Source: Frost & Sullivan (2016). Future of Global Retail Healthcare Delivery Markets, Forecast to 2022

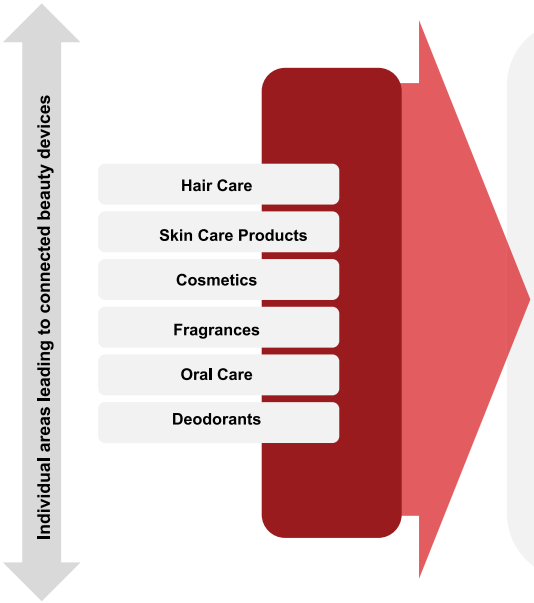
2.3. Cosmetic Segments Market: % of Total Market (2015)



The total revenue across all these beauty segments in 2015 was close to USD $56 billion dollars.

Source: Frost & Sullivan (2016). Innovations in Cosmetic Procedures (TechVision)

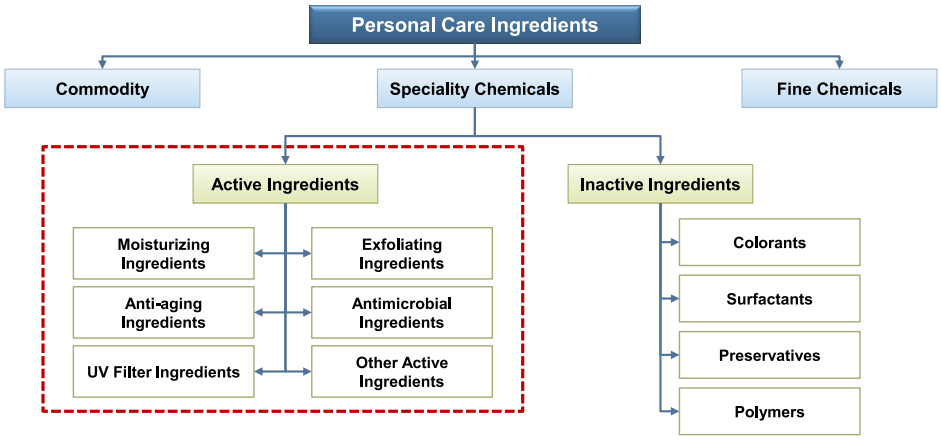
2.4. Product Matching in Cosmetics



- There could be a range of brushes that are customized for the type of hair and texture that an individual has, using the genetic personalization method. Brushes could also have inbuilt sensors that detect the amount of hair fall and potentially recommend products that can be utilized to reduce these issues.
- There are already a range of products in the market that assess skin and give a detailed description of hydration, temperature, and bacterial quantity in the form of an smartphone application.
- The development of product matching in cosmetic that will enable people to purchase complementary products. It can assess the individual through facial recognition and recommend what products can be used for attaining the required look.
- In this convergence scenario, a range of products that are part of the cosmetics space, will be combined with personal care products as well as all of the emerging technologies that have been assessed to innovative highly exclusive beauty solutions that are connected.
- This will increase the potential of selling products based on an individual consumers preference and how well it suit his or her body and needs.

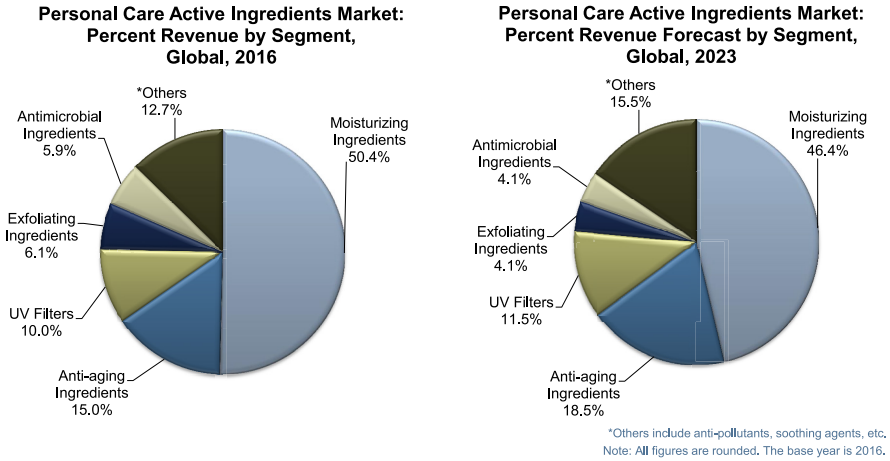
Source: Frost & Sullivan (2016). Innovations in Cosmetic Procedures (TechVision)

2.5. Personal Care Ingredients: Product Segmentation



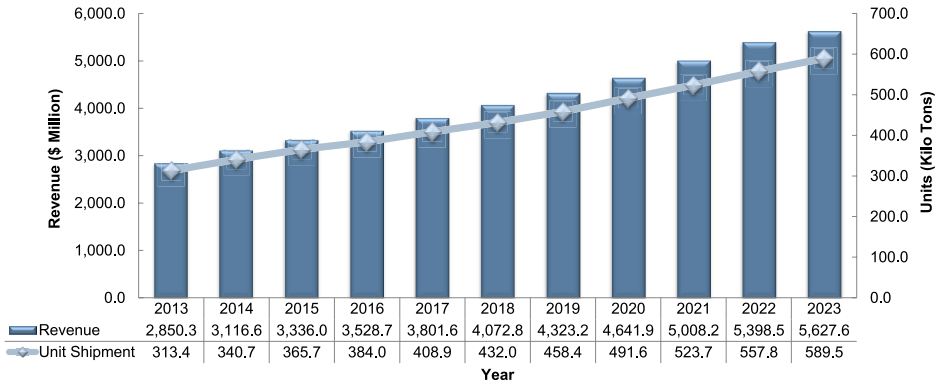
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.6. Personal Care Active Ingredients Market



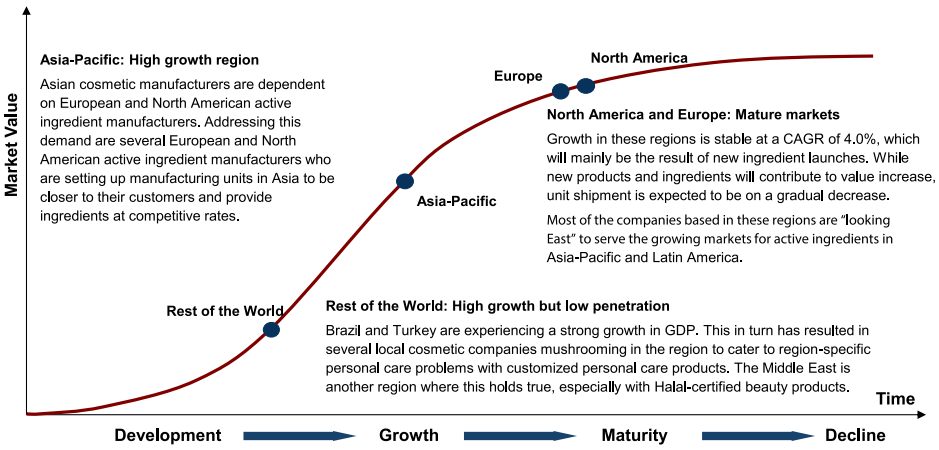
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.7. Personal Care Active Ingredients Market: Revenue Forecast (2013-2023)



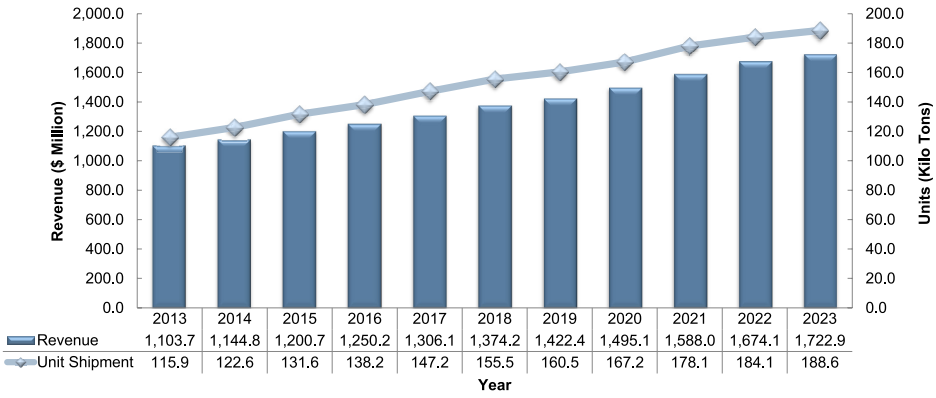
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.8. Personal Care Active Ingredients Market: Life Cycle.



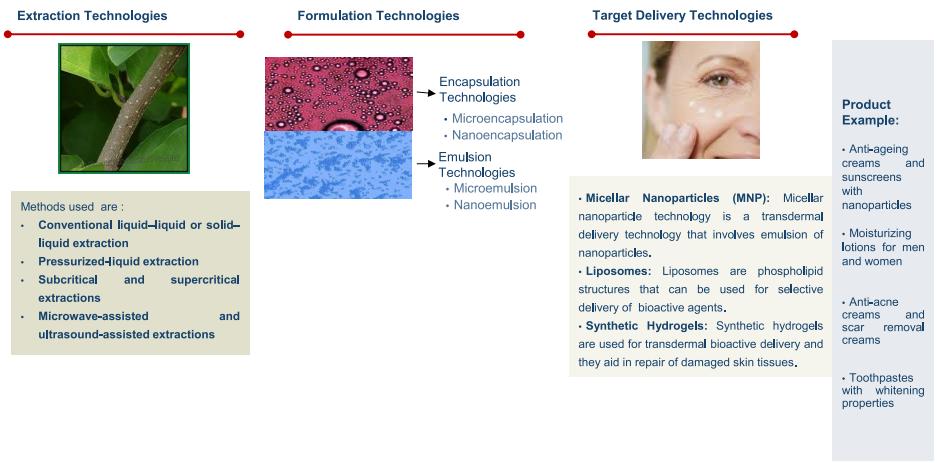
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.9. Personal Care Active Ingredients Market: European Revenue Forecast (2013-2023)



Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.10. Bioactive Technologies Capability



Source: Frost & Sullivan (2013). Emerging Trends in Bioactives for Personal Care (Technical Insights)

2.11. Bioactives in Personal Care Industry: Key Drivers and Challenges

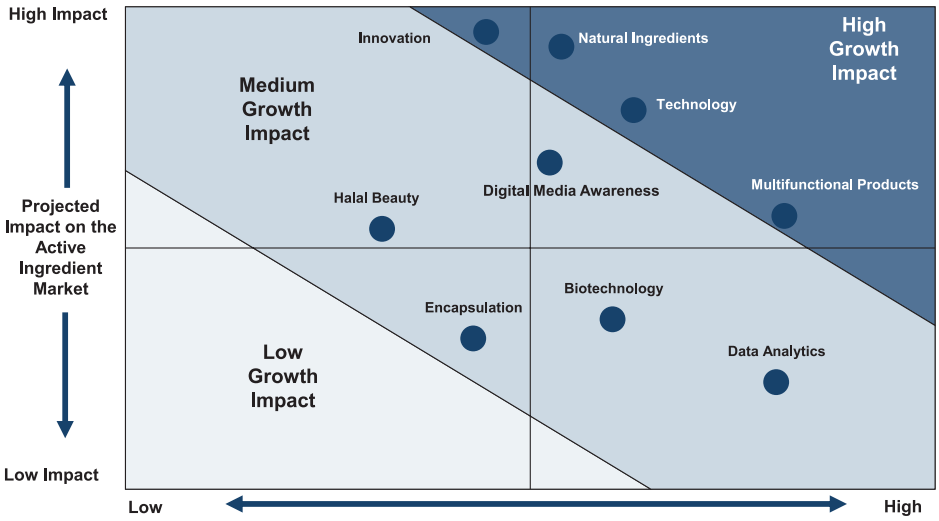
Drivers	1–2 Years	3–4 Years	>5 Years
Preference for natural ingredients	●	●	●
Peer pressure and concern for aesthetic appearance	◕	●	●
Advances in technology development	◑	◕	●
Power of social media	◔	◑	◕

Challenges	1–2 Years	3–4 Years	>5 Years
Biocompatibility of naturally-derived bioactives	●	◕	◑
Proving product's efficacy for functional claim of the active ingredients	◕	◕	◑
Highly competitive market requiring rapid innovations in strategic, technical, and marketing concept in the personal care sector	◑	◕	●
Potential of allergic reactions and irritation	◕	◑	◔

High ● Low ○

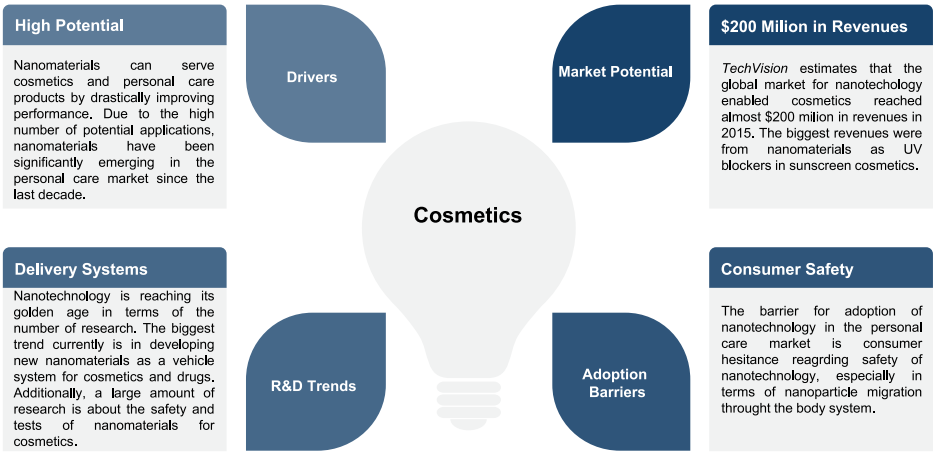
Source: Frost & Sullivan (2013). Emerging Trends in Bioactives for Personal Care (Technical Insights)

2.12. Personal Care Active Ingredients Market: Product, Material and Technology Trends (2016-2023)



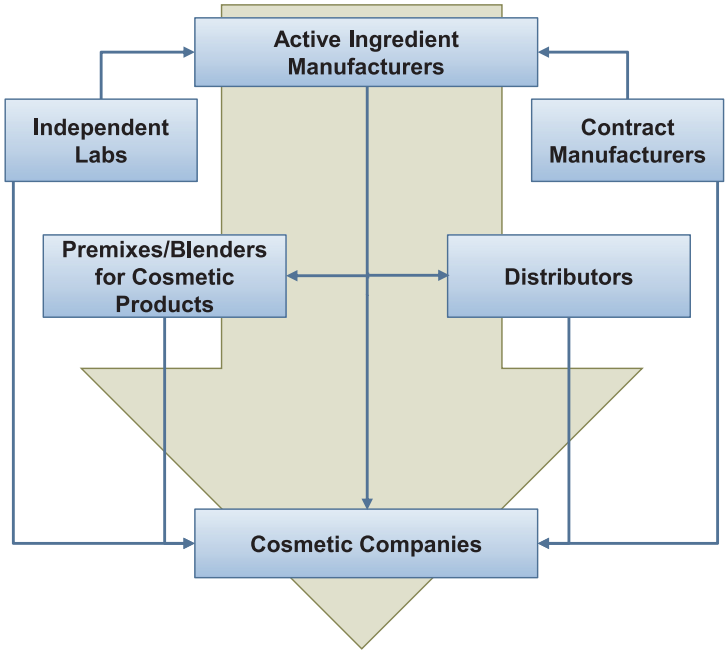
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

2.13. Nanotechnologies for the Cosmetic Industry: Strategic Insights



Source: Frost & Sullivan (2016). Advances in Nanotechnology for the Cosmetic Industry – Nanotech TechVision Opportunity Engine

2.14. Personal Care Active Ingredients Market- Value Chain



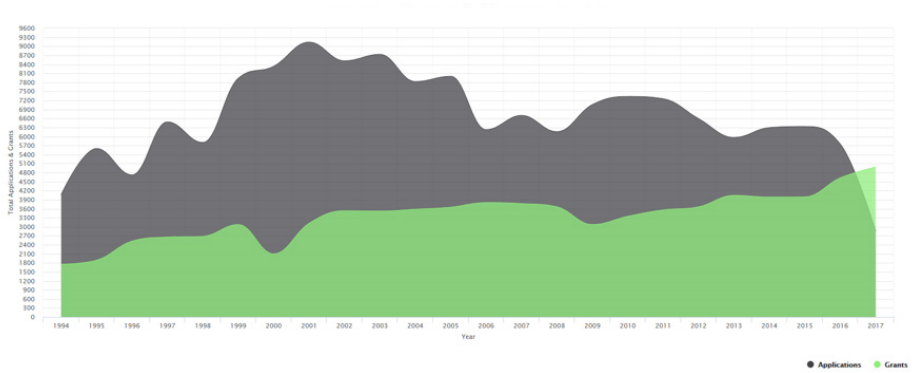
Source: Frost & Sullivan (2017). Global Personal Care Active Ingredients Market, Forecast to 2023

3
Patent analysis

The cosmetic industry plays a very important role in the development of products lead by highly innovative science. This is to provide new technologies and more efficient, safe and sustainable methods of development for new products with highly relevant research programs in this field.

3.1. Evolution of patents applied for and granted

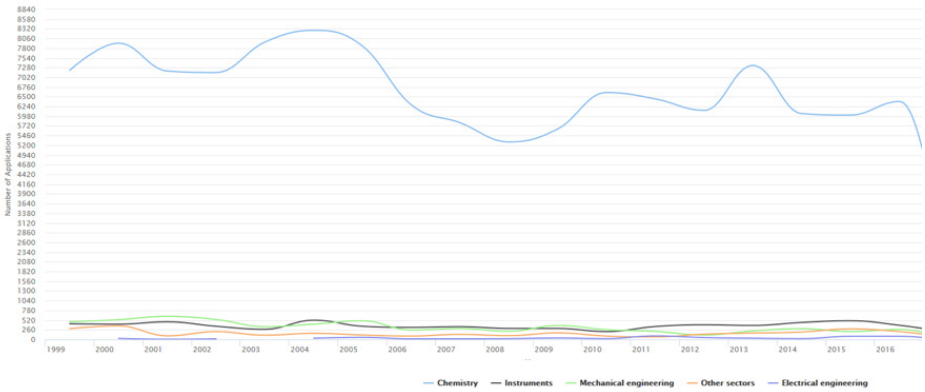
An analysis of the patents applied for and granted over that last few decades reveals the growing tendency of the sector. On average in this area of knowledge, 51% of patents applied for are granted.



Source: PatBase. Query: November 2018

3.2 Technological sector of the patents applied for

Over the last 20 years, the technologies more involved in the patents applied for in the field of the cosmetic industry belong to the following fields: instrumental chemistry, mechanical engineering, electronic engineering and other sectors. Among these, the field with greatest relevance is undoubtedly, that of chemistry.

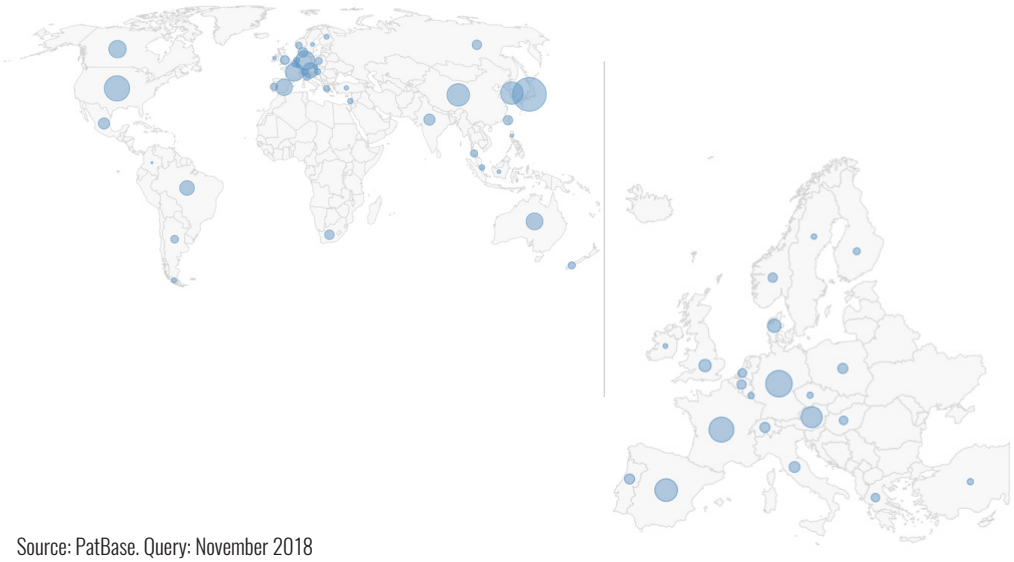


Source: PatBase. Query: November 2018

3.3. Localització sol·licituds de patents

Japan is the country with most patent applications in this field, followed by the United States and the European Patent Office.

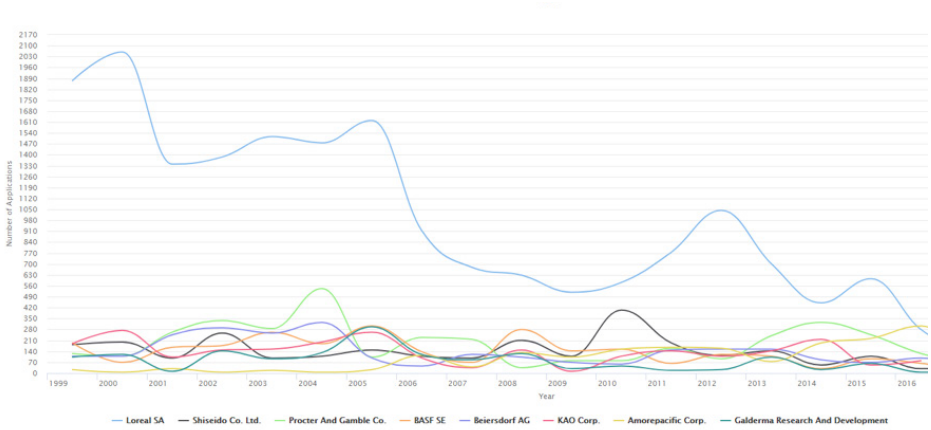
In Europe, the countries where most patents are applied for are, in this order, Germany, France and Spain.



Source: PatBase. Query: November 2018

3.4. Most active patent applicants over the last 20 years

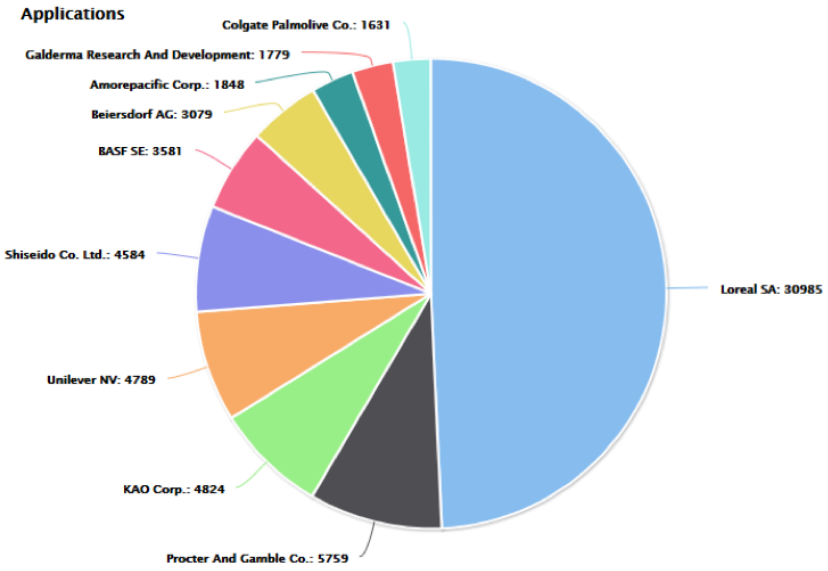
The graph below shows the eight most active applicant organisations over the last 20 years, as well as the periods in which these applications were concentrated.



Source: PatBase. Query: November 2018

3.5. The 10 most active applicants

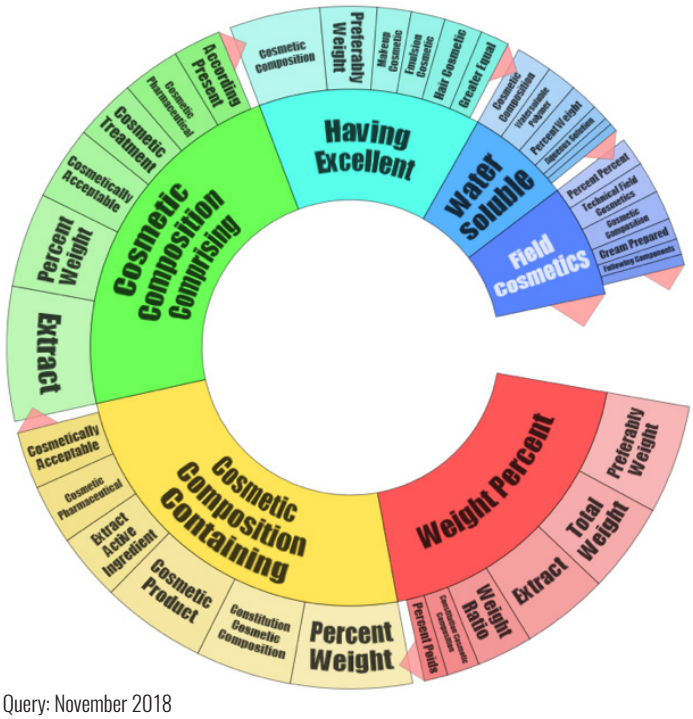
The ten most active bodies (companies, institutions or people) filing patent applications, including the number of applications for each one are shown below.



Source: PatBase. Query: November 2018

3.6. Keyword analysis

The main keywords associated with patent applications in the field of study are: cosmetic composition, solubility, percentage weight and cosmetic chemical properties.



Source: PatBase. Query: November 2018

3.7. METHODOLOGICAL APPENDIX

The data provided in the "Patent analysis" section refers to a study carried out on a sample of 194,316 patent applications in the field of new innovative cosmetic products, and focused on global activity over the last twenty years, with greater emphasis on Europe.

49,556	**28,295**	**194,316**	**263,17**
Patent family	Family of patents granted	Applications	Publications
Total number of families in this set of results	Total number of families with publications granted with this set of results	Applications with this result	Publications within this result

Source: PatBase. Query: June 2018

For the words alluding to technologies for innovative cosmetic products, the criteria used to make the query on which this report is based was the "widest range in the field", so as not to impose any limits. Patent documents are classified in different international classification systems, the most often used being the International Patent Classification (IPC). Pursuant to this nomenclature, obtaining the sample for this report considered the inclusion, among others, of the following indexes:

- A61K8/00 Cosmetics or similar toilet preparations.
- A61Q19/00 Preparations for care of the skin.
- A61Q5/00 Preparations for care of the hair.
- A61Q 3/00 Manicure or pedicure preparations.
- A61Q 1/00 Make-up preparations; Body powders; Preparations for removing make-up.
- A61Q 17/00 Barrier preparations; Preparations brought into direct contact with the skin for affording protection against external influences, e.g. sunlight, X-rays or other harmful rays, corrosive materials, bacteria or insect stings.
- A61Q 90/00 Cosmetics or similar toilet preparations for specific uses not provided for in other groups of this subclass..

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