"AI-Powered Innovation: Revolutionizing the Cosmetics Industry for Personalized Experiences and Sustainable Growth"

Trabajo de Grado

Maria Gabriela Mora Ocampo

Bogotá D. C, Colombia

2025

"AI-Powered Innovation: Revolutionizing the Cosmetics Industry for Personalized Experiences and Sustainable Growth"

Trabajo de Grado

Maria Gabriela Mora Ocampo (Administración de Negocios Internacionales)

Tutor

Saeed Mousa

Bogotá D. C, Colombia

2025

Acknowledgement

I want to thank God for giving me the possibility to fulfill my dreams every day, to my supervisor Saeed Mousa for guiding me in the best way in this project, for all his support during the process of elaboration and for always answering my doubts in the best way, his disposition and experience was a key piece in my research.

I would also like to thank my parents for always encouraging me and giving me the chance to get everything I want for my life, to my boyfriend who believed in me at all times, gave me all his support throughout my master process and always reminded me of what I am capable of, and finally, I want to thank all the people who participated in my interviews, thank you for your time and for giving me excellent content for my research.

Declaration of Academic Integrity and Personal Work

I declare under oath, that I have written the title document "**"AI-Powered Innovation: Revolutionizing the Cosmetics Industry for Personalized Experiences and Sustainable Growth**", in the degree option of graduating project and that therefore, its content is original. I declare that I have clearly and precisely indicated all direct and indirect sources of information and that this work has not been submitted to any other institution for the purpose of qualification or publication.

Signature:

Maria Gabriela Mora Ocampo

Confidentiality Agreement for Graduating Project

I declare that this work is solely the author's intellectual property. The Universidad del Rosario is not responsible for the content, opinions, or ideologies expressed in it, either totally or impartially.

Maria Gabriela Mora Ocampo

Table of Content

Figure list

Table List

Glossary

Act: this stage its crucial in the plan, it need to ensure that users are understanding the value proposition of the product and are willing to know more about it.

Ad targeting: the use of propensity model can enhance the ad targeting by identifying the right ad content for the right segment. This is translated into a more efficient ad placement saving costs concerning traditional methods

Engage: the last step it is based on the post-purchase management of customer relationship, building and facilitating brand loyalty and engagement:

Marketing automation: Marketing automation is adopted through the automated platform for the strategic creation of email marketing, customer relationships management, data analytics, lead management, and landing pages. Some platforms can create a single ecosystem in which all the tasks are supported and integrated to be in harmony and efficiency in the strategy through all channels (omni-channel approach).

Reach: Total number of households that will be exposed to the message through a particular media channel over a set up period.

Re-targeting: can help the brand to bounced traffic after they leave the website, giving a new CTA to capture the attention again and achieve the convention goal

Resumen

Este estudio pretende comprender el papel transformador de la inteligencia artificial en la tecnología de la belleza, centrándose en cómo la IA y las experiencias personalizadas están revolucionando la industria, impulsando la eficiencia operativa y el crecimiento sostenible. En los últimos años, ha habido un creciente interés en el crecimiento de la tecnología de la belleza, los consumidores están adoptando comportamientos más sostenibles

Todas las ideas recogidas de los profesionales de la industria son cruciales para dar respuestas a la pregunta principal y dar una perspectiva de lo que la industria de la belleza debe esperar en los próximos años.

Palabras clave**:** Sostenibilidad, Inteligencia Artificial, Cosmética, Personalización, Crecimiento, tecnología, Comportamiento del consumidor

Abstract

This study wants to understand the transformative role of artificial intelligence in the beauty tech, focusing on how AI and Personalized experiences are revolutionizing the industry, driving operational efficiency and sustainable growth. In recent years, there has been a growing interest in growth in the beauty tech, consumers are adopting more sustainable behaviors

All the insights gather from industry professionals are crucial to giving answers to the main question and give a perspective of what the beauty industry should expect in the next years.

Keywords: Sustainability, Artificial Intelligence, Cosmetics, Personalization, Growth, technology, Consumer behavior

1. Introduction

The beauty tech industry has been growing over the years, especially in emerging countries like Colombia. The cosmetic industry is one of the most powerful and high revenue areas of the economy that's why the beauty tech is having a boost in the creation of beauty startups, personalization processes and never seen formulations. Also, the tech Implementation has changed the game, all the companies are using AI and augmented reality functions to provide hyper-personalization a quality that the customers are looking out, with this they can ensure to have a better experience not only in the buying, in the process of creating the makeup and in the post purchase, having the opportunity to have your own formula that its perfect for your skin conditions its one of the goals of the beauty tech, also with the personalization the processes can be more effective since the AI have all the data of the client and with that they can create product the customer would love and thanks to that the customer loyalty will increase. This thesis looks how the AI can continue improving the cosmetic industry driving it to sustainability and growth for the new markets.

1.1 Background and motivation

The use of cosmetics it goes back to 5,000 years ago and today the beauty industry is worth an estimated of $435 billion. Through history, beauty and technology were separate from each other, but now they work as one bringing unique products and services. "Consumers will be

always looking for something extra in terms of performance and results. They will not compromise on quality, efficacy, security and sincerity" (Tan 2017); with that information and products being show to the customers the beauty tech has everything to revolutionize the industry. The hyper-personalized can provide ease shopping experience not only in E-commerce but also in retail experience, like having adequate stores with AR mirrors, testers of the formulas and AI assistants that can provide a unique experience, it is known that the consumers has the power to redefined constantly the industry with new trends and with that also give a guidelines to the market in what product they need to focus or what can of experiences the customers are expecting.

The main motivation of this research is understanding how the beauty industry can be revolutionized by AI especially in my country Colombia, how the companies can use this technology to ensure sustainable growth in their process and generate an added value to the customers and to the industry. Makeup its more than a product it is a way of expressing yourself, also a tool for empowering women around the world and generate growing in the economy.

2. Literature review

2.1 Metaverse and Artificial Intelligence

2.1.1 Definition of Artificial Intelligence

According to Google, artificial intelligence is a set of technologies that enable computers to perform a variety of advanced functions, including the ability to see, understand and translate spoken and written language, analyze data, make recommendations and more.

AI is the backbone of innovation in modern computing, unlocking value for individuals and businesses. Through AI applications, processes of automation and optimization, dynamic pricing and prediction can be utilized in various ways across organizations to achieve several benefits.

2.1.2 What is the Metaverse?

Metaverse is the post-reality world, a perpetual and persistent multi-user realm that merges physical truth with digital virtuality. Accordingly, Metaverse is an interconnected network of social and networked immersive realms on persistent multi-user platforms. It enables dynamic customer communication embodied in dynamic relationships and in real-time with digital instruments. Its first version was a network of virtual universes where avatars could teleport among themselves, the function of a digital PC or a PC-controlled robot to do usually similar tasks with capable beings.

2.1.3 What is Machine Learning?

According to IBM, machine learning is a branch of computer science that focuses on the using of data and algorithms to enable AI to imitate the way that humans learn, gradually improving the tasks.

In the context of data mining, selecting the right approach for the task at hand is crucial, which often involves using machine learning techniques. A key distinction between humans and computers has traditionally been that humans naturally improve their problem-solving methods over time. They learn from past mistakes and seek out new strategies to address challenges. In contrast, traditional computer programs don't evaluate the outcomes of their tasks, so they can´t improve their behavior. Machine learning specifically tackles this issue by developing computer programs that can learn and enhance their performance by accumulating more data and experience: the first scientist to develop a self-learning program. In 1967, the first pattern recognition program was developed, which could identify patterns in data by comparing new information patterns in data by comparing new information to known data and recognizing similarities.

The concept is often applied to the plan of developing systems endowed with the intellectual processes particular to humans, such as the function of thinking, making sense, generalizing, or learning from past experiences. Since the development of the digital computer in the 1940s, it has been shown that PCs can be programmed to do quite complicated tasks (such as finding proofs of mathematical theorems or playing chess) with great skill. Still, despite continued advances in PC processing speed and memory function, there are still no programs

that can match total human flexibility in broader domains or in tasks that require a lot of daily understanding. However, certain programs have reached management levels of professionals and human experts in the execution of certain specific tasks, which is why AI (artificial intelligence) in this reduced sense is in applications as different as doctor diagnosis and research engines. computing, voice or writing recognition, and chatbots.

2.1.4 History evolution of artificial intelligence

Artificial intelligence is a subfield of computer science that copies the total process of human intelligence into machines. It involves developing intellectual capabilities traditionally associated with human beings such as perceiving speech or image, understanding natural language and decision-making process. In the 1950s a group of scientists first came up with an AI concept and start talking about how many machines that good think just like humans do. Since then, AI has made great progress and become one of the revolutionary technologies today in the subsequent decades, researchers try other AI techniques like machine learning and neural networks. In future chapters we will go deeper into explaining these techniques and their relation to AI as well as the constraints of this. The advancement of AI was very slow until the 1980s, until hardware and software began to improve which caused a resurgence in the field.

However, it is crucial to make a difference between hardware and software when we try to think about what AI really means.

Hardware: physical part of a computer is such as the monitor keyboard and mouse other input output devices, these components execute the introduction from the software, so these include the CPU, RAM, hard drives and graphic cards.

Software: software is mainly a troupe of programs that provide instructions to the software. This software includes an operating system and all of the applications, some program that computers used to operate, tools like word processors Google Docs browsers like Chrome or Firefox.

2.1.5 Use of Artificial Intelligence in the 21st century

Due to significant manipulation in the techniques and styles of society, as well as the business process AI is one of those ground-breaking technologies that have benefitted millions of people in a very short time.

The evolution of Artificial Intelligence has profoundly transformed the way we interact with technology and how we perform our own professional development and tasks. Artificial Intelligence is increasingly capable of doing complicated cognitive tasks, replacing repetitive tasks and even making choices based on monumental volumes of data. This transformation has a direct effect on social paradigms and the union market, creating new opportunities, but also generating concerns about the future of work.

Both hardware and software rely on each other to function properly. Hardware needs software to give it instructions, and software requires hardware to execute those tasks. Without

one, the other would be ineffective-hardware would be ineffective-hardware would just be a collection of parts, and software would have no platform to run on.

Automation driven by Artificial Intelligence is reshaping the landscape of the union market. Several tasks previously performed by humans continue to be replaced by capable machines. However, this transformation also opens space for new job opportunities that require complementary skills to artificial intelligence. Experts who acquire knowledge in data science, machine learning and data studies will be prepared to take advantage of the opportunities of this new scenario.

2.1.6 Types of Competitiveness

Artificial intelligence is transforming modern industries, and its impact on small businesses is particularly profound. By integrating AI with Michael Porter's model-based competitive differentiation, companies can increase the ability to compete and innovate successfully. Porter, in his influential book “The Competitive Advantage of Nations (2011),” identifies three main types of competitiveness: cost, differential and direct competitiveness.

The integration of AI in medium businesses offers many opportunities to differentiate their competitiveness. For example, AI-powered chatbots can provide personalized customer service, which can set a medium business apart from competitors that rely on traditional customer service methods and traditional ways of working. Either businesses can use AI to analyze customer data and create tailored product recommendations, through the customers’

insights compiled from the data analysis, with the SME can deliver a more personalized customer experience than competitors using more traditional approaches.

We can mention some of the benefits of differentiating the competitiveness of the companies by adapting to AI integration. One of the main benefits of integrating AI into businesses is the advantage to offer customized and hyper-personalized products and services in a high speed. It can increase the capacity to create tailored product recommendations that are more likely to meet the expectations of the consumers and the market. This can help businesses strengthen customer relationships and increase customer loyalty, which also open doors to attract new customers looking for personalized and unique experiences.

Another advantage is the AI´s capacity to make better decisions, as decision-makers within companies provide real-time information and data analytics that can help guide business strategy and decision-making. companies that are “early adopters” of AI can gain a competitive advantage by offering innovative and different range of products and services.

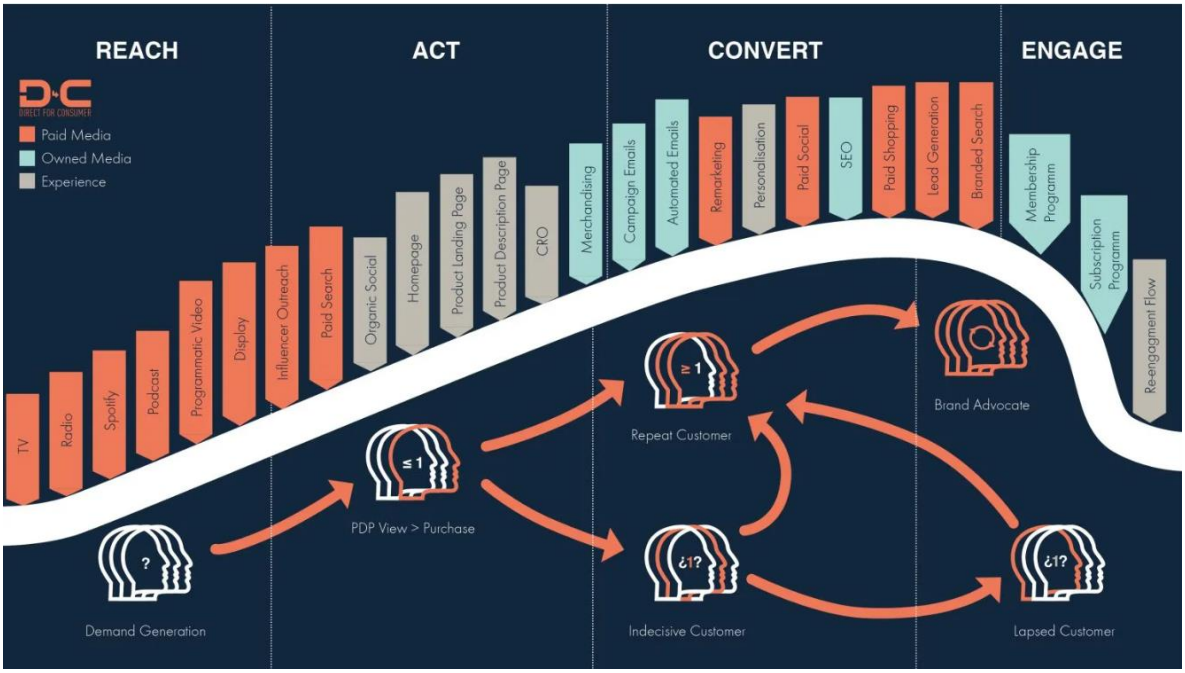
2.1.7 Measure growth with digital consumer journey

The customer journey now involves integrating innovative solutions into the digital marketing strategy. Today's consumers are not restricted to the traditional funnel and can move across various channels throughout their customer preferences. This framework ensure that businesses focus their efforts and budgets on the right areas, also at the same time aligning with

the digital trafficking. For understanding better how digital marketing can boots the buying process the RACE framework can be used, the four main stages when creating a media plan.

Figure 1

Digital customer journey stages



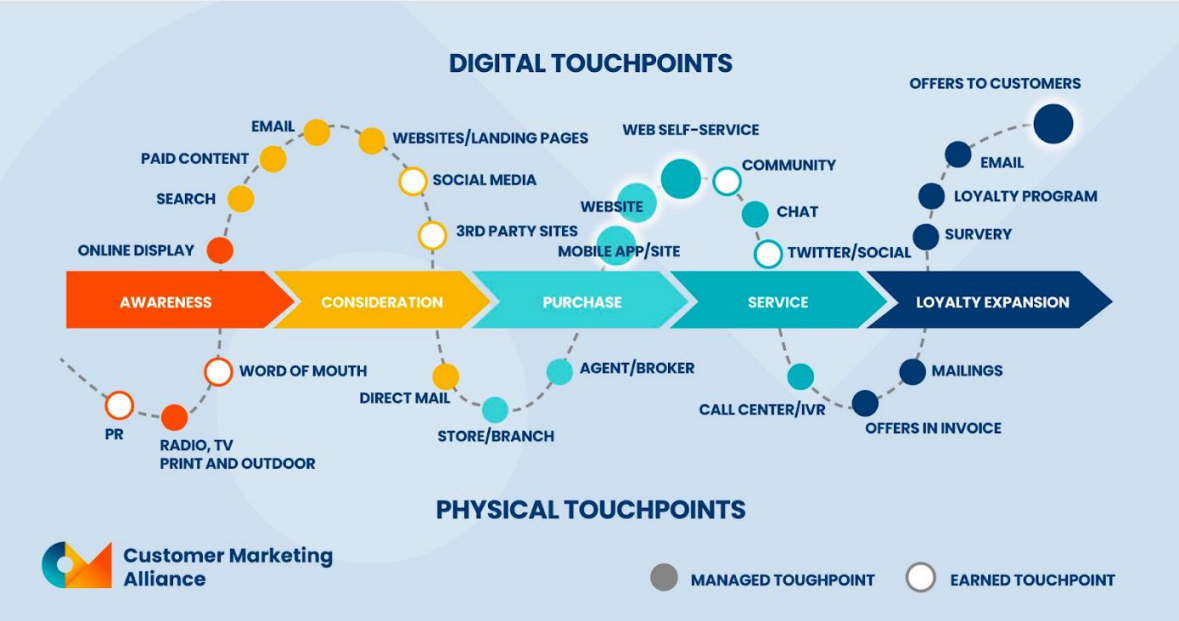
Note: Reproduced from *Mapping the customer journey in marketing*, from A. Stephens and G. Grupta, 2025, Customer Marketing Alliance, https://www.customermarketingalliance.com/mapping-out-the-customer-journey-and-finding-your-audience/

- **Owned Media:** refers to all media channels owned by the company, so they are managed completely and independently by it. All social media channels, websites, email marketing and more belong to this category.
- **Earned Media:** it refers to all media channels that are created by users thanks to the "words of mouth" or social sharing (reviews, shares, reposts, recommendations) and they are not under the control of the advertiser

- **Paid Media:** refers to all media channels where it is necessary to invest a specific budget to ensure relevance to the audience to better increase brand awareness and/or advertise the product/service. Digital channels are becoming more and more popular: Meta Ads and Google AdWords are example of a paid media channel; However, the most traditional like print, display, TV and radio are still used

Figure 2

Digital touchpoints



Note: Reproduced from *Mapping the customer journey in marketing*, from A. Stephens and G. Grupta, 2025, Customer Marketing Alliance, https://www.customermarketingalliance.com/mapping-out-the-customer-journey-and-finding-your-audience/

Going deeper in the customer journey, integrating artificial intelligence tools can significantly improve customer experience while also streamlining and automating repetitive tasks for marketers. The cross-functional collaboration its needed to achieve a good media strategy this tactics are focus in every stage of the funnel and helps to stay focused in the planned goals.

Reach: Total number of households that will be exposed to the message through a particular media channel over a set up period.

- **Act:** this stage its crucial in the plan, it need to ensure that users are understanding the value proposition of the product and are willing to know more about it.
- **Ad targeting:** the use of propensity model can enhance the ad targeting by identifying the right ad content for the right segment. This is translated into a more efficient ad placement saving costs concerning traditional methods
- **Re-targeting:** can help the brand to bounced traffic after they leave the website, giving a new CTA to capture the attention again and achieve the convention goal
- **Engage:** the last step it is based on the post-purchase management of customer relationship, building and facilitating brand loyalty and engagement:
- **Marketing automation:** Marketing automation is adopted through the automated platform for the strategic creation of email marketing, customer relationships management, data analytics, lead management, and landing pages. Some platforms can create a single ecosystem in which all the tasks are supported and integrated to be in harmony and efficiency in the strategy through all channels (omni-channel approach).

2.2 AI in beauty tech

2.2.1 Definition of Cosmetic Industry

Cosmetics are natural or formulated based products that are used to refine the appearance by making clearer the features and to maintain hygiene. The beauty products that are considers as make up are the: powder, lipstick, eyeshadow, mascara etc. By the other hand the hygiene products are soap, lotions, shampoo and products that are for the body.

Thanks to the Egyptians we have these products, in history we know that they use plants and fruits to make tints, also natural pigments for their rituals. At the beginning of the Christian era, cosmetics were widely used in the Roman Empire. Kohl (a preparation based on lamp black or antimony) was used to darken eyelashes and eyebrows and outline the eyelids. Blusher was created with tints of the flowers and fruits and in that way, they give color to the cheeks, and powders were used to simulate or enhance light skin since in that time the only skin that was considered “Beautiful” was the light skin.

Many years after the European continent will fall into the Roman Empire during the 5th century. It was a hard time for everyone, the violence, lack of money for eat was the main preoccupation for all the citizens and the personal look was forgotten. Cosmetics reappeared on the European continent on a huge scale during the Renaissance, and Italy (15th and 16th centuries) and France become one of the most influential countries in the makeup industry, since de French revolution to nowadays we can see the French influence in the formulas.

What we know it’s that makeup was used only used by royalty, their courtiers, and the aristocracy, but during the 18th century cosmetics had come to be used by every social class. Europe has been a pioneer in the scientific development and construction of cosmetics throughout that time. After the First World War, all Anglo-American prejudices against makeup were gone, and new products and techniques of construction, packaging, and advertising made cosmetics accessible on an unprecedented scale.

The evolution of the cosmetic industry reflects changing standards of beauty, technological advances, and social dynamics throughout history: ancient civilizations such as the Egyptians pioneered beauty practices, using natural ingredients such as kohl for eye shadow and scented oils for skin care, they believed that cosmetics had spiritual and protective properties.

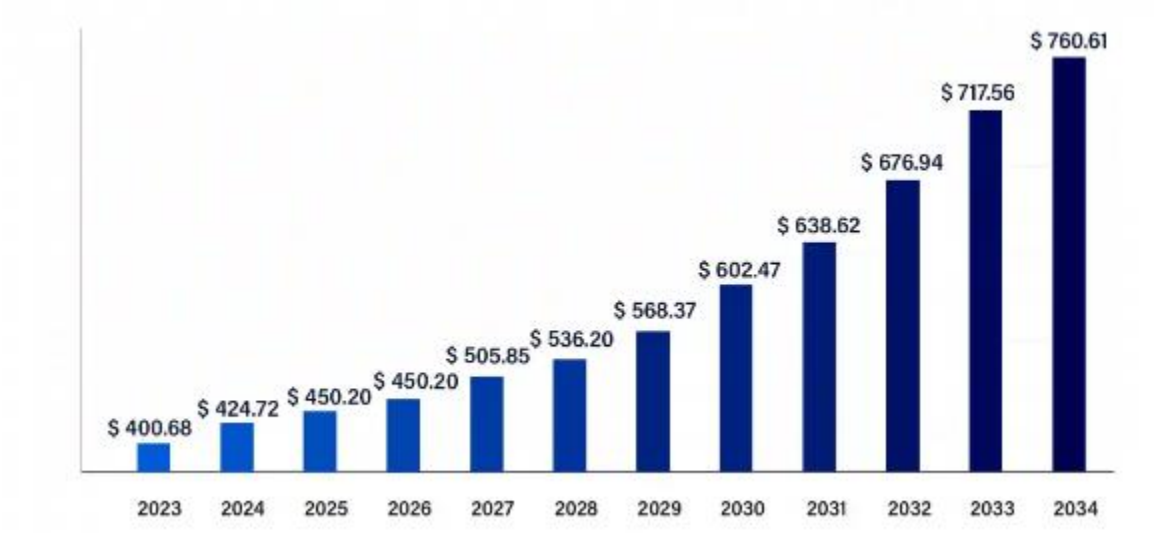
Beauty is a tradition passed down, through time, from mother to daughter, and was the only access to information regarding beauty techniques and knowledge. Many of those recipes were also a reflection of popular beliefs on the power of nature and the theory of the four humors.

2.2.2 Market size

Cosmetics brings to the market a wide range of products that can vary significantly in their characteristics, depending on the type of item and its intended use. Skincare products, for example, are primally used to protect and enhance the appearance of the skin

Figure 3

Cosmetics market size 2023 to 2034



Note: Reproduced from *cosmetics market size 2023 to 2034*, from Anonimo, 2024, precendencesearch, ***https://www.precedenceresearch.com/cosmetics-market***

The cosmetic industry is among the most profitable and robust industries worldwide. In 2021, its global value reached $511 billion, and it is expected to surpass $784.6 billion by 2025, with an annual growth rate of 4.75%: this steady and rapid growth is driven by consumers' willingness to pay higher prices for premiums cosmetics and by the rising purchasing power of emerging countries, which provide new market opportunities for companies.

Key market players including L´oreal S.A, Shiseido Co. Ltd, Beiersdorf AG, and others are launching AI/AR technology-based mobile applications to educate users about their skin and beauty care profiles. Shiseido Co. Ltd, the largest Japanese cosmetics manufacturer, developed "Beauty AR Navigation," a digital application to educate consumers about facial skin health profiles and how to take care of your skin with their products.

The self-care and grooming trend have increased worldwide in recent years, with women being the main target of the cosmetics industry. Concern about body and well-being increases day by day due to a busy schedule, changes in routine, eating habits, and fluctuations in sleep cycle. Beauty products can enhance the quality, cleansing, and beauty of external body parts and thereby help individuals look healthier and more attractive

Several factors have contributed to the growing demand for cosmetic products among both younger and older generations. The rising use of products like sunscreen, skin serums, foundations with high coverage are having the highest demand. Manufacturers are also offering a diverse range of products, such as creams, and gels tailored to different skin and hair types, which is expected to achieve market growth. Additionally, brands are focusing on personalization and the integration of technology to attract more consumers. For example, L'oreal group introduced My Hair ID: the all-in-one app that every stylist needs, the app powers stylist expertise to provide professional diagnosis, new and improved Virtual Try-on VTO, inspiration and much more through in-built-tailor-made tools that include:

Figure 4. ***INOA ID Mockup, taken from L'oreal webpage***

iNOA ID: the first in-salon augmented color service for professional diagnosis and Virtual Try-on to define the ideal shade combination: it includes more than 4K formulas powered by oil and personalized with tech available at stylists' fingertips.

Metal Detox: aids in the identification of metal exposure of the client´s hair and recommends the

Style My Hair: putting artificial intelligence to work for consumers through virtual: L'Oreal professional´s style my hair app lets consumers try out an augmented reality hair makeover. The innovative tool harnesses revolutionary technology and reflects L'oreal´s determination to offer users an ever-wider array of services

First released in 2015, the app was originally designed as a makeover tool, before evolving to become a service platform for hair stylist and consumers.

The new version offers an augmented reality experience: users can get 3D makeover, film themselves in real time, and try out different looks right on their phone.

To do that, it developed a mixed deep-learning model based on two artificial neural networks. These networks are trained to use 180,000 images to recognize the shape and structure of each person strand, as well as the overall shape of the user's hair. The result is hair texture and color that match reality.

The app is also a platform for connecting stylists and potential customers. A geolocation system allows users to find the nearest salon in their city. They can also contact their favorite salon directly and send pictures of their new look. The realistic try-on provided by the app are designed to make stylists diagnostic work easier.

2.2.3 The Metaverse as Playground

Gravitas: the new hairstyles created in collaboration with a CGI artist and a global hairstylist:

In November 2022, L'Oréal Professional became the first hair brand to enter the metaverse with five looks available on Ready Player Me. In collaboration with a CGI artist, Evan Rochette, the brand created diverse virtual hair looks for cross-gaming avatars. Thanks to the success of this first launch hairstyles ranked in the top 5 of the most downloaded looks on the platform.

2.2.4 Revolutionizing Digital Consumers

At the same time, hair salons are trying new things to increase their appeal. New business models, such as shared lounges, have begun to gain popularity. Electric Space is one example. Cosmetics is leading the digital transformation of the industry with an approach that simultaneously focuses on both professionals and consumers. It now offers distribution services, educational resource platforms, connected tools for salons and virtual fittings, as well as online appointment booking through apps such as Revieve and Wavy. Professional beauty is constantly reinvented. Innovation in diversity, equity and inclusion technology creating the most powerful B2B ecosystem in the professional beauty industry. Salon Centric is the first-ever marketplace dedicated to beauty professionals.

It is a powerful partner for stylists in the United States. Salon Centric, originally known for its physical stores and sales teams dedicated to reach beauty professionals, launched its online sales platform and Salon Centric Marketplace, providing digital access to an extensive catalog of products and services. Hairdressers are supported by every step of the purchasing journey, learning about brands, special offers and events. The platform also includes a feature

that allows them to create lists and manage their stock, leaving them more time to spend with customers and connecting with their community. Is a one-stop shop for inspiration, education and innovation in physical and digital formats.

A current cosmetic trend gaining significant traction is the green beauty movement. Economically, sales of green cosmetics in Europe are growing at an annual rate of 20%, with projections for even higher percentages in the coming years. In Europe, the countries most engaged in this trend include Germany, with sales reaching 6 billion euros, followed by France which is increasingly producing cosmetic products that adhere to organic standards (Cervellon, 2011)

On a global scale, over 70% of consumers in China, India, and Brazil have shown a positive interest in purchasing green cosmetics. Generally, there is a perception that products labeled as “green”, “organic”, or natural are safer than conventional cosmetics, as consumers believe these products contain more active and pure ingredients than standard cosmetics items.

2.2.5 What is Beauty Tech?

Is the intersection between technology and the beauty industry, taking the sector beyond eye shadows and one size fits all hair care. Through the rise of online shopping, influencer industry and social media platforms, consumers are confronted with a huge range of brands to provide more personalized customer experiences.

In this new era of beauty tech, it’s easier for clients to customize treatments and formulas for specific needs, with high technology and precision the industry is revolutionizing the way we used to know makeup. AI-powered skincare and makeup, try on apps and smart beauty products

are driving the future of the industry, for example, skin tone match is a groundbreaking way to understand the type of skin, color and characteristics and with technology consumers can get unique skincare advice specifically for their needs and goals.

The beauty tech offers many benefits to both professionals and consumer users, it can help brands deliver personalized product recommendations, making it easier for customers to find the products that are best for their necessities. Additionally, AI and AR technologies offer shoppers a personalized experience by allowing them to virtually try on products or get advice from beauty apps.

2.2.6 Company Success

In Latin America, the beauty salon industry is a major player in the customer service sector, with more than 700,000 salons and one million beauty-related businesses. Countries like Brazil, Mexico and Colombia demonstrate great demand; the latter has one room for every 800 people. However, the industry's supply chain has seen little innovation in more than four decades, and a staggering 85% of salons have yet to adopt digital tools, leading to inefficiencies and structural limitations.

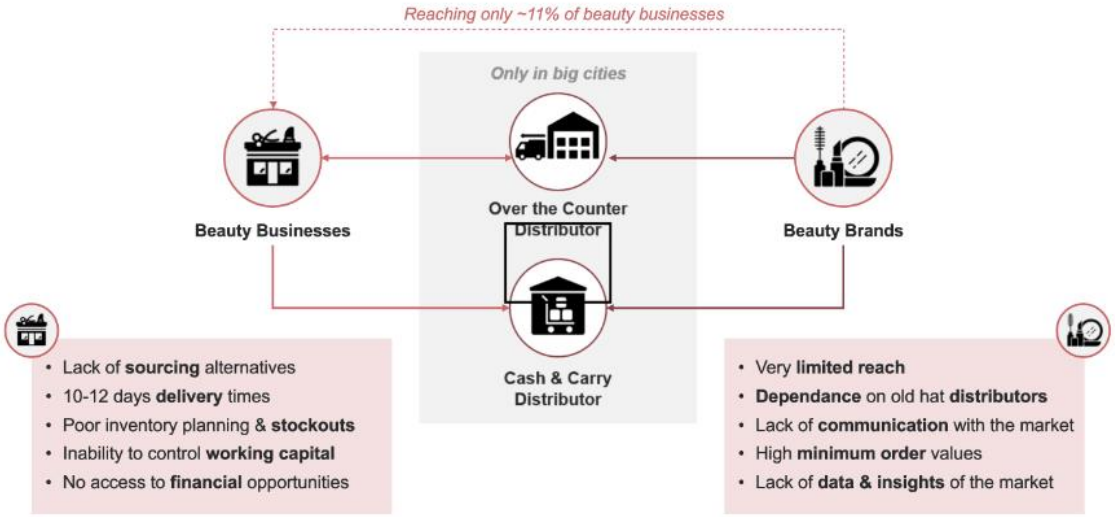


Figure 6. ***"Why we invested" femsa ventures***

In my thesis I want to explore the transformative potential of digital platforms in the cosmetics industry and tech, using Morado as my example I want to highlight the key success and challenges the startup goes through. The company focuses on addressing barriers such as limited product access in Colombia and offers a digital commerce platform aimed at beauty salons, barber shops, and spas. Through its marketplace, customers can purchase beauty products, uniforms, cosmetics, and even materials with flexible payment options and fast delivery.

A key factor in Morado´s success has been its ability to adapt to the needs of the customers. The startup identified that many businesses in the beauty sector face challenges related to product access and financing. Morado not only provides a comprehensive catalog of supplies but also offers credit options for salons. Recently, Angela maria Acosta, founder and CEO of Morado secured $5 million in funding round led by the major venture capital firms.

Morado plans to launch "Morado Academy" a training platform for its commercial partners, with support from leading brands in the industry. This approach aims to strengthen the supply chain and contribute to the growth and modernization of a sector that has traditionally seen low technological adaptation.

2.3 Sustainability in the cosmetic industry

2.3.1 What Is Sustainability?

The Brundtland report defines sustainable development as “development that meets the needs of the present without endangering the ability of future generations to fulfill their own needs” (United Nations, 1987, p589). This approach encourages a way of viewing consumption and production that does not compromise the needs of future generations (Peattie & Charter, 2003). Sustainability it’s become a very relevant topic for companies nowadays, it now represents a vital quality in many ways. Global warning and overwhelming planet situation have increased awareness of issues related to contamination, climate change, and waste management, leading companies to focus on pursuing a more sustainable industry.

Consumption has reached its limits, mislead by the conception of more consumption equates to more progress. This misconception is often influenced by economic priorities that tend to overshadow it. Consumption itself is not such a bad thing, it becomes dangerous when consumers and companies forget the potential downsides.

Climate change and global warning have become now impossible to ignore. Many environment actors and components have already and feels like it is not stopping. This phenomenon clearly affects everyone, since the high temperatures seen are provoked primarily by human activities. This situation has raised concerns within society and among organizations including the United Nations, which has proposed reversing or at least mitigating the effects. However, despite numerous efforts, these initiatives have so far proven insufficient (Sandoval & Breña, 2019).

This graph highlights, on the one hand, different dimensions of sustainability relevant to the cosmetics industry, from the adoption of sustainable ingredients to efforts at minimizing environmental impact through green energy and effective waste management by recycling and reduction of plastic use. It also details trends in consumers' preference for organic and natural ingredients, supported by regulations pushing for sustainable manufacturing processes.

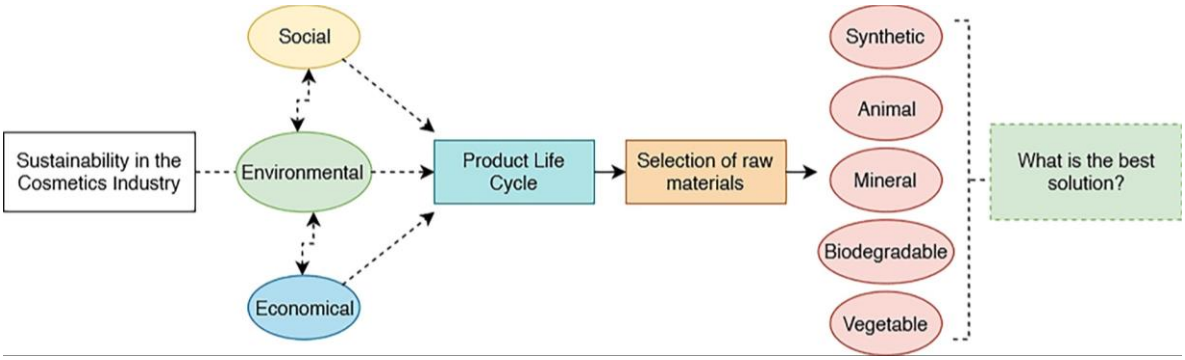


Figure 7. ***cosmetic sustainability cycle***

2.3.2 The Product Life Cycle

The innovations in the cosmetics industry go from the very beginning, the product design and the ingredient selection, all the way through manufacturing, packaging, distribution and post consumers disposal, each step impacts sustainability. The labels like “organic”, “natural” and “green” are everywhere, but these aren´t necessarily the same as “sustainable”. While terms like organic and natural usually focus on how ingredients are grown or sourced, sustainable cosmetics consider the whole process: environmental impact, social ethics, and even economic factors. In that case the green products might contain mostly natural ingredients, but truly sustainable products ensure that every step, from source use to packaging, meets sustainability goals.

Many big companies in the beauty industry, like Garnier and L´oreal Paris, are making waves by integrating sustainable practices throughout their product lifecycles. Taking the example of L´oreal Paris “for the future” the initiative has ambitious targets for 2030, including cutting greenhouse gas emissions by half per product, managing water sustainability, eliminating deforestation practices, and sustainably sourcing ingredients, reducing water use, and supporting hundreds of communities worldwide.

Choosing the right raw materials for cosmetics products is key to ensuring sustainability across all dimensions: environmental, social, and economic. At the same time, consumers are more environmentally conscious than ever and demand products that cause less harm to the planet, with resources like water and minerals running low, deforestation and biodiversity loss are real.

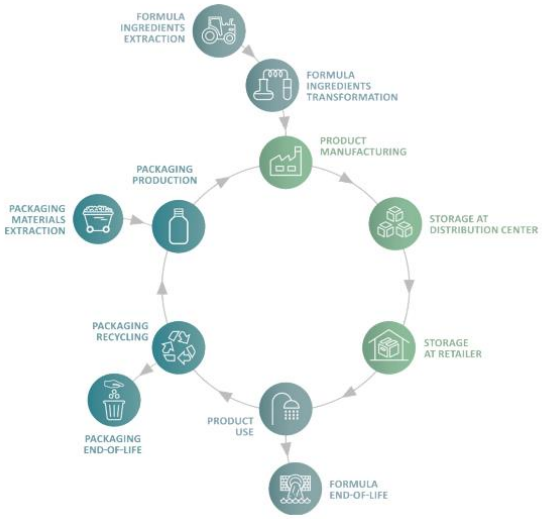


Figure 8. ***cosmetics life cycle***

When selecting raw materials for cosmetics, several factors should be considered. How biodegradable the ingredients are, where they come from, and how they´re processed. Raw materials can be classified as natural, organic, naturally derived, natural-identical or synthetic, each with its own impact. The natural ingredients come straight from nature, plants, animals or minerals, while organic ones come from farms that avoid using synthetic fertilizers and pesticides. But synthetic doesn´t always mean bad for the environment, just as natural isn´t always good. Garnier, often used in makeup, and palm oil, found in various products

Cosmetics also use active ingredients from animal by-products, like fish or dairy. Waste from agriculture and food production can be transformed into sustainable, cost-effective, and

safe alternative to traditional plant extracts. Eco-friendly farms that avoid pesticides provide even safer extracts for cosmetics.

There is a growing interest in environmentally friendly products, causing customers to seek out sustainable options more than in the past. Life cycle assessment (LCA) assists in examining the environmental impact of products throughout their entire lifespan. It is crucial to think about the possible harm that cosmetics and personal care products could cause when they eventually end up in the environment, due to their increasing popularity.

Some cosmetics components: such as UV filters, parabens, and plastic, are causing significant environmental issues because of their effects on ecosystems. Lately, these has been an increase in industrial waste due to the production of disposable by-products that can be reused by many industries. These secondary products often contain beneficial substances, that; when processed correctly, can be transformed into beneficial component for both cosmetics and pharmaceuticals.

Figure 9. ***taken from L'oreal's sustainability report***

2.4 Sustainability Considerations

2.4.1 Reduced Waste Through Customization

Personalized products could significantly add up to waste reduction in the cosmetic industry. When given products based on individual needs, brands can help consumers avoid the trial-and-error approach that they usually go through in order to have the product that fits the most. For instance, tools like Sephora's Color IQ give customers the chance to identify their precise product, reducing the likelihood of going and purchasing multiple products that may not be a good option for them or simply won't reach consumers expectations. Virtual try-ons further support this by enabling users to test out shades and styles before buying, helping them make informed decisions without the need for physical samples (Rayome, 2018).

By producing customized products brands also reduce the chances of customers to return products which might end having huge environmental impacts due to the repackaging and shipping that contribute to carbon emissions. AI prediction tools would help brands to produce more accurately match products, reducing overproduction and excess inventory. This approach not only helps consumers avoid wasted purchases but also allows companies to align production more closely with actual demand, decreasing waste and improving resource efficiency.

2.4.2 Eco-Friendly Product Development

Besides, AI and big data drive innovative product development that generates minimal waste in the value chain. AI technologies will, therefore, be instrumental in helping leading brands measure consumer interest in sustainable ingredients, eco-friendly packaging, and ethical sourcing for companies to develop products that align with modern consumer values while

treading softly on the environment. Data analysis will be used to understand consumer preference for cleanliness and natural ingredients, providing insights into formulation decisions for brands wanting to avoid synthetic chemicals that might be contributing to ecosystem degradation.

This development contributes to sustainability by manufacturing the trending or in-demand product, probably reducing extra inventories and packaging wastes. This tool will let the companies create only personally customized products upon order, such as special skin care formulations or refill packaging. This just-in-time production approach cuts down on surplus stock and lowers the carbon footprint associated with mass production, making it an eco-friendly alternative to traditional manufacturing processes (Jiao et al., 2022).

In addition, brands are using AI to optimize sourcing and manufacturing logistics, reducing the energy and materials needed to produce each item. When using data to analyze the behavior of supply chain in the company, they can make better decisions in favor of environment regarding ingredient sourcing, packaging materials, and transportation methods. The use of data enables companies to reduce environmental impact while still offering the high degree of personalization consumers expect.

2.5 Introduction to Personalization in the Cosmetic Industry

Personalization is a term used daily to describe products tailored to specific customer preferences, based on individual data collected from customers. It is widely used across different sectors, with many companies adopting it as a strategy to increase revenue and improve the shopping experience.

The cosmetic industry is no exception. The industry was, at the beginning, focused on sale a one fit for all products, it used to offer a limited range of products designed for broad audiences. Over time, they have begun to offer more diverse and tailored products.

Today, with the rise of new technologies like AI, the metaverse, and a broader technological revolution, the industry has had to pay closer attention to using personalization as a strategy to stay competitive. Personalization is now seen as a key factor for success in an industry where consumers increasingly expect unique and tailored experiences (Bäckerås, 2019).

New technologies have greatly enabled a more personalized experience in both product offers and customer shopping experience. Tools like machine learning, predictive analytics, and computer vision, allow companies to gather and process data, ultimately to deliver data-based outcomes on how each product should be produced, how can they come up with new products, how to offer a product for a specific target and how to improve customer experience.

Personalization can also be dangerous, since it was established to match customers preferences to increase loyalty and boost sales, it also involves handling customer private data, and it could backfire as customers can perceive personalized products as a way of privacy violation. Other than just the perception on the attributes each product has, the price ranges could vary as customers are interpreted as being willing to pay more for something more accurate for them. Manipulating prices could result as a potential loss.

2.6 Data-Driven Personalization

2.6.1 Data Role

The personalization process relies in various key factors, such as, creativity, innovation products and production processes, but how do companies know what exactly what their customers need to provide such tailored products? The answer lies in data.

Manipulation of individual data from customers is the most crucial aspect of the personalization process since it collects the necessary tools to create new products based on customers preferences. Data-driven personalization in cosmetics involves collecting and analyzing extensive consumer data, including purchase history, preferences, and even biometric information like skin type and tone (Wang et al., 2003).

This data works as a foundation to establish customer profiles in order to create targeted products. In the context of skincare, for instance, it allows companies to develop customized recommendations that address specific needs, such as acne treatment or anti-aging solutions (Bäckerås, 2019).

2.6.2 Tools for data analysis and personalization implementation

Now that we have discussed data, and how important it is for personalization, is time to explore how companies can carry on such processes taking advantages from emerging technological tools. One of the most common uses of data manipulation is data mining, that consists in interpreting and analyzing the data gathered to generate insights. Most industries use it to discover patterns and correlations from within their databases. Some of the most popular techniques used in data mining are classification (organizing data into categories), clustering (grouping similar data points) and regression (predicting outcomes). These are some techniques applied in the cosmetic industry.

- **Sentiment Analysis with NLP:** Natural Language Processing (NLP) can help companies categorize consumer feedback into positive, negative and neutral sentiments. Within the cosmetic industry it can be used from surveys and direct feedback from customers related to their products and shopping experiences. Algorithms like Support Vector Machine (SVM) enable precise classification, which can then inform product recommendations based on consumer emotions (Ganga et al., 2022)
    - **Regression:** In the cosmetics industry, regression can help analyzing customer sensibility to price adjustment in the past to forecast how it can be adjusted better in the future. Regression can identify optimal price point that could maximize revenue without significantly reducing demand.
- **Clustering techniques in Personalization:** Clustering in the cosmetic industry can effectively ensemble shared characteristics in order to precisely target tailored products to specific segments. Wang et al. (2003) highlight how clustering and association rules can segment consumers into groups with similar behaviors, allowing for more targeted marketing strategies.

2.6.3 Technologies enabling customization in cosmetics

We have seen that the importance of data and analytics has gotten higher with time, thus forcing the cosmetic industry to expand and embrace new technologies. Consumer data today helps companies craft the brand around the user experience rather than vice versa. As mentioned before, personalization has become a central strategy. Now, it is time to take a look at how companies within the industry actually implement the data gathered with new technologies to improve the consumers' experience.

As a result of the new technology available, the industry can not only perform elementary data analysis but can also tailor the offerings and experiences within the shortest time frame. Augmented reality, as well as artificial intelligence and machine learning, are transforming the process of consumption of beauty items across the globe. The AI-driven systems evaluate the skin and personal likes and dislikes to offer the best-fit recommendations, while AR helps a person to put on the desired makeup they want to wear online. Moreover, the great amount of consumer information is analyzed, and original solutions are implemented quickly due to the technologies of big data and cloud computing.

These technologies allow companies to not only meet consumer expectations for customization but also elevate the overall shopping experience. By embracing tools that offer personalized insights and interactive features, brands can ensure that every product aligns with individual needs, creating a more engaging and satisfying customer journey.

2.6.4 Augmented Reality (AR) and Virtual Try-Ons

Augmented Reality (AR) is a game changer in the cosmetic industry which comes with so many options to customize your look. This technology allows customers to try on AR cosmetics and personal care products virtually, improving the overall experience. Thanks to AR, products can be visualized on the face without applying them, as the customer can realistically assess how lipstick, foundation or eyeshadow look in practice. Often, customers are given a fresh and innovative way of viewing AR cosmetics with numerous styles and shades allowing for more personal experience when shopping this particular AR market.

Sephora, a leader in the beauty industry's digital transformation, has successfully integrated AR into its customer experience through its Sephora Virtual assist tool. Developed in partnership with ModiFace, this AR powered tool allows users to try on and combine thousands of different shades of makeup. By simply using their smartphone camera or an in-store space, customers can virtually apply products like lipstick, eyeshadow, and foundation to see how they would look in real life. The facial technology behind Sephora Virtual Artist is highly precise, mapping facial landmarks, such as lips, eyes and skin tone, to make sure that virtual products are shown accordingly. This gives consumers a highly realistic preview of the product (Rayome, 2018).

In addition to this tool, Sephora has also used AI to enhance its AR offerings with features like Color IQ. This tool helps customers find their perfect product by analyzing their skin tone through a digital scan. After analyzing, they are given a unique color IQ code, which filters through thousands of shades to recommend the best match for their skin tone. The innovation addresses a key customer pain point: Finding the right shade among a long line of available products (Rayome, 2018)

Besides, it has also broadened its AR functionalities in the physical locations by incorporating the Tap and Try function, allowing customers to choose and virtually apply any lip or lash product using AR technology. To enable its operation, RFID technology was integrated with Sephora Virtual Artist, enabling customers to receive instant, customized recommendations in the moment (Rayome, 2018). By incorporating these technologies, Sephora guarantees that all aspects of the shopping experiences are tailored for individual preferences and ease of use.

2.6.5 3D printing for customized products

3D printing represents an innovative technique that has emerged to develop customed cosmetic products whose specifications are exactly matched to those required by a particular consumer. Technology enables cosmetics formulation and packaging to be customized with precision using deposition of materials in a layer-by-layer manner. It meets most of the criteria for a novel manufacturing technique, including personalization, waste reduction, and the creation of complex structures not easily achieved by traditional techniques.

3DP offers a few promising features in the cosmetic industry, particularly on personalized products, for example, lipstick, foundation, or skincare patches. For instance, 3D printing has been used to create customized lipstick by adjusting the shape, color, and formulation to meet individual preferences (Jiao et al., 2022). In addition, this technology allows cosmetic companies to manufacture anti-acne patches and other skincare products that are made to the specific needs

of the user. With the right materials, 3D printings can provide personalized skincare solutions, which enhances product efficacy and consumer satisfaction.

One of 3DP's primary benefits is its ability to precisely and meticulously deposit active components in a controlled manner, ensuring uniformity and consistency. Technologies like fused deposition modeling (FDM) and stereolithography (SLA) have been successfully employed to create complex cosmetic goods, such as microneedle patches. By penetrating the skin's outer layers, these compounds boost skin delivery. These microneedles transfer active ingredients, such hyaluronic acid, directly into the skin, making skincare more targeted and effective.

Finally, 3DP contributes to the development of environmentally friendly and sustainable packaging solutions. Cosmetic companies may minimize waste, cut down on extra inventory, and create more sustainable production methods by creating well-liked items. Both product and packaging personalization complement the extensive industry trends towards sustainability of personalization, making 3D printing a key technology for future innovations in cosmetics.

2.6.6 Impact on Consumer Experience and Satisfaction

Given the high importance of personalization in the cosmetic industry, it is necessary to look into its direct impact on consumer experience and satisfaction. With all of the technological, AR, AI, Data Management and 3D printings, cosmetic brands are creating tailored experiences that resonate deeply with individual consumers. Other than improving products and providing more personalized experiences, it enhances the engagement consumers have with brands, fostering trust and loyalty. However, while this process offers new positive opportunities for companies, it also introduces, as mentioned at the beginning, potential challenges regarding data privacy and the risk of diminishing the human touch in customer service. We are now going to

dig deeper into how personalization affects customer engagement, increases brand value, and the potential risks associated with these technologies.

2.6.7 Enhanced Customer Engagement

The technological tools give an advantage for the industry since it creates meaningful connections with customers by offering spaces of interaction with AI, AR and 3D printings. This approaches not only benefit customers by offering them products tailored to their needs and characteristics, but also fosters an emotional connection with the brand, encouraging long-term loyalty. In this section we will talk about some insights into how personalization could lead up to creating lasting brand-consumer relationships.

One key aspect of this enhanced engagement is the personalization of interactions, which AI facilitates through various channels. Many enterprises send personalized emails or ads based on data gathered regarding previous purchasing behavior, browsing habits, or even social activity. This approach, known as dynamic personalization, ensures that customers feel that the brand understands their individual preferences and needs (Babatunde et al., 2024). Other than that, AI tools like chatbots and virtual assistants offer real time every day personalized support, improving overall shopping experience by answering customers queries instantly.

Much more technologies are implemented to enhance engagement, there is the Natural Language Processing (NLP), which analyzes customer reviews, social media conversations, and other unstructured data. From this data companies and brands can understand better customer sentiment, to adjust communication channels based on this individual type of feedback. By closing paying attention to it, customers would feel listened in order to keep building loyalty.

The gamification of personalized experiences is another method that has been widely implemented and contributes to higher engagement. AI can personalize challenges, rewards,, and other aspects of a gamified experience based on customer preferences, further immersing users in the brand's ecosystem and keeping them engaged longer (Babatunde et al., 2024). Just as the other technologies, it creates a loyalty environment by creating an enjoyable and interactive customer journey.

As mentioned above, tools used by Sephora, such as AI and AR, into shopping is a prime example of how personalization contributes to the customer engagement enhancement. Sephora Virtual Artist gives customers the opportunity to try on products virtually, which makes customers to feel closer to the brand as it's a presentation of how companies in the industry are taking into account customers more each time. Not only by offering new products and launching new innovative social media campaigns, but by creating fun spaces in which customers can interact and visualize products before they come out. This level of engagement keeps consumers connected to the brand and more likely to return for future purchases.

To sum up, implementing personalized experiences build a deeper emotional connection between consumers and brands, significantly enhancing customer engagement. The more companies focus on offering personalized experiences that make seem to the customers that are being considered, the more likely they are to remain loyal to the brand. As new digital tools rise, brands could take advantage and create long-lasting relationships with ther customers through meaningful, personalized interactions.

2.6.8 Increased Perceived Value

As new technological tools are implemented to offer more personalized products the perception of the brand increases. It elevates significantly the perceived value as products are

seen as higher quality and more valuable. In such a complex industry in which offering specific products to a wide variety of skin types, tones and lifestyles, the ability to deliver personalized products is a strong indicator of brand sophistication and quality.

The increased perceived value can be measured in consumers' willingness to pay more for premium products made to make them feel considered. AI-powered tools like Sephora's Color IQ provide consumers with precise skin tone matches, giving the idea that products are uniquely suited to their needs. When brands leverage Augmented Reality (AR) for virtual try-ons, customers can further experiment with looks before purchasing, adding an interactive and personalized touch that bolsters their trust in the brand's commitment to quality (Rayome, 2018)

Moreover, other technologies implemented like 3D printing allow companies to produce products that are truly personalized. Brands can also be perceived as providers of luxury when being able to customize items like anti-aging treatments with exact specifications. According to Jiao et al. (2022), the precision and uniqueness afforded by 3D printing add to the exclusivity and desirability of products, creating a premium appeal that translates to a higher perceived value in the eyes of consumers.

The great personalization these technologies allow means it does not just make the brand stand out, but also ensures stronger customer loyalty. When consumers believe a brand pays attention to their personal needs, they are most likely to believe in its products, come back for more, and even refer the brand to others. Such perceived value is a differentiating factor in brand reputation, enabling companies to keep their lead in an increasingly competitive market.

2.6.9 Potential Challenges

While all the explained above might picture the process as perfection, the implementation of advanced technologies also represents facing several challenges that brands must navigate to maintain consumer trust and loyalty. These challenges include concerns over data privacy, the risk of over-relying on artificial intelligence (AI), and the potential to lose the human touch in customer interactions.

2.7 Data Privacy Concerns

As brands increasingly rely on consumer data to deliver personalized experiences, the collection and management of personal data raise significant privacy issues. AI tools used for recommendation in several products are usually based on sensitive information gathered like skin types, consumers' browsing history and purchasing patterns. For example, Sephora's use of Color IQ AI-driven personalization tools and similar technologies provide a personalized experience by requesting and gathering extensive data that is typically considered private and sensitive. This gathering of data seems invasive, especially if consumers do not know how their data is being utilized (Rayome, 2018)

Due to the increasing number of data breaches, consumers may be resistant to provide personal information to brands out of concern that it might be misused or disclosed. If brands are unable to address customer's concerns about data security, it could hinder the possibility of personalized service being embraced. As a matter of fact, companies in overcoming such fears will have to show transparency through effective communication on how their data is collected, stored, and used by putting in place high levels of security to safeguard consumer information.

2.7.1 Over-Reliance on AI and Technology

Since AI was introduced many companies starting to face how not to rely only in it and keeping a human touch in its various offerings. While AI can efficiently analyze consumer data and offer personalized recommendations, it may not give some interactions that only a human touch can achieve. For example, virtual try-ons or AI-powered skin analyzers provide technical insights, but they lack the empathy and understanding that a trained in-store beauty consultant could offer.

There is a tendency where overdependence on AI intelligence relates impersonally, a factor that in the long run would reduce customer satisfaction. Consumers appreciate suggestions from various experts giving informed advice and product recommendations based on contextualized experiences and expertise, skills for which AI is yet to match. Brands need to balance AI-driven tools with human judgment to ensure that the consumers come out well-served.

2.7.2 Balancing Personalization with Consumer Expectations

When finding such tailored products there could be a misperception between personalization and manipulation. As industries grows and the rise of digital tools, consumers start to feel uncomfortable when given recommendations overly targeted or if pricing appears to vary based on personal data. For instance, consumers might worry that companies are using their data to adjust prices based on their willingness to pay, a practice known as price discrimination. This can lead to a loss of trust if consumers feel they are being unfairly charged more based on personal data or browsing history (Babatunde et al., 2024)

Maintaining this balance can be achieved only by paying due attention to the limit of personalization, keeping AI recommendations subtle, yet aligned with consumer needs, and not

intrusive. The firms have to create transparent policies of data usage and pricing so that it can give a sense of security to customers that personalization has been implemented in order not to take advantage of them but for their benefit.

In summary, while personalization brings valuable opportunities to the cosmetic industry, brands must also manage the complexities associated with data privacy, AI reliance, and consumer perceptions of manipulation. Addressing these challenges thoughtfully will be crucial to sustaining customer trust and maximizing the benefits of personalized experiences.

2.8 Consumer behavior and decision making

Consumer behavior focuses on how personal customers, families, or communities make choices to spend their accessible resources. For understanding this model its necessary to always do these questions, why they shop it, when they shop it, where they shop it, how often they shop it, how often they use it, how they evaluate it after purchase and use, the effect of those evaluations on future purchases. and how they eliminate it.

An understanding of consumer behavior is necessary for businesses when setting up product development, marketing strategies and sales plans, especially in e-commerce nowadays, in the industry the customer is everything and understanding what they one it’s the best way to achieve success, the companies that have more information about their customers have the advantages of responding quickly to new trends or what the market wants.

Cultural factors also have a deep influence on consumer behavior, the demographic data its fundamental for launching a product and also with that the companies can identify the target they need to attach in the strategies, since the offerings in the markets are vast and have many

differences of products its necessary to know which one is the right to buy according to the customer's needs. All customers battle various inconveniences associated with purchasing products and services to satisfy needs and desires. Since solutions to these problems are vital to the reality of most people and the economic peace of all, they are often not taken lightly. The consumer should make specific types of choices to obtain the desired products or services. The process is complex since choices must be made about what product or service to buy and why, how, at what time, where, and how often to buy it.

The importance of the media in the dissemination of concepts cannot be underestimated. Beauty and attractiveness. Sending messages about looking clean and smelling good was necessary to reinforce the cultural psyche and sell more cosmetic products, inducing women to behave and feel a certain way. Many factors influence consumer behavior and in many ways. that a consumer might behave, for example, a customer could behave: rationally, analyzing every aspect of the product - and the market in general - before purchasing something; irrationally, strongly influenced by advertising and marketing in general; behavior could also focus on emotions, positive feelings related to a product; Finally, a buyer could be precisely looking for a product that helps them achieve a goal (Shallu, 2013). An interesting study (Wu et al., 2016) on impulsive behavior in cosmetics. marketing activities highlight that, for this specific category of buyers, the only important factor that influences purchase intention is the purchasing experience. Specifically, the article analyzes the experience that these consumers have in a beauty store - or online - when discovering a cosmetic product.

3. Methodology

3.1 Method

For this thesis, the research method will be qualitative, focusing on conducting semi-structured Interviews with experts in the cosmetic industry and entrepreneurs of my country. A total of ten interviews will be conducted to gather insights and opinions on the research question in the framework of ***"How AI-driven innovation in the cosmetic industry contributes to long-term sustainable growth and enhance customer personalization, versus potentially compromising data privacy and increasing operational costs?"***

By selecting this qualitative methodology, it provides a dynamic space for the exchange of knowledge and at the same time allows the experts to share their valuable experience, thereby, contributing to a comprehensive understanding of the subject in the matter, also giving more flexibility to create a more natural conversation to exchange point of views and finally to add extra value to the interview and ay the end to the study.

Several tools will be used in the process of the interviews, firstly, the use of Zoom meetings, given the impossibility of a face-to-face interview with the candidates, which in turn is a positive aspect since we can connect from all the world and it was perfect since a lot of my interviewees need to travel a lot so organizing the meetings was easy, I need to use the translator since mostly all the answers were in Spanish.

3.2 Sampling

The sampling method used to select the experts for the interviews will be purposive sampling. The expertise of the people has worked directly with the study focus and allows the interviewer to select potential candidates by a deliberate selection of participants based on different positions considering some qualitative skills as expertise, experience, and relevance to the research topic. In this case, the participants will be Start-up owners or employees who have experience within the cosmetic industry or an outstanding record in the Tech industry.

Since we are talking about a semi-structured interview, the sample was ten high-quality interviews giving to the research sixty very complete answers, selecting industry experts, entrepreneurs, and tech developers with years of experience in the sector

3.3 Data analysis method

The data analysis method for this thesis will be framework analysis. This method involves a systematic process of organizing and analyzing the qualitative data collected from the interviews. The framework analysis process consists of the following steps:

The first phase, familiarization, this step involves carefully reading all the interview transcripts to become familiar with the data and identify initial themes and patterns among the 10 participants. When it's done, I can proceed to identify a thematic framework; based on the research objectives and the topics that emerged during the phase.

In the second phase, Indexing, with each framework I will go through each transcript and identify each theme looking for patterns in the answers, I will pass to the charting which consists of creating charts to summarize the data of each theme, making it easier to compare and analyze the information across interviews.

The last, phase will be the mapping and interpretation, in this part, I will analyze the charts to identify patterns, trends, and relationships with the data presented, and focus on my conclusions based on the research objectives.

In the end, what is going to be done is to extract verbally word by word and in a comparative table where horizontally you can see the answers of each of the interviewees in parallel with respect to each of the questions asked in the questionnaire .

4. Results and Analysis of the Interview Questions

4.1 Do you think AI and digital processes impact the quality and innovation of product development?

Table 1

Product development and AI, own construction

Violeta	Aron	Camilo	Angela	Diego
"I believe that automating processes and using AI for personalization are key to driving innovation in the industry. It helps me reduce production times and reach a larger audience while offering customized products. Also, I can deliver more relevant experiences and strengthen"	"In my experience as an AI startup owner, I´ve found that AI and digital processes directly enhance both the quality and innovation of product development. They allow us to quickly adapt to customer preferences by analyzing data in real-time, resulting in more targeted and high-quality products. Additionally, AI enables us to experiment rapidly"	"With 15 years at L´oreal Colombia, I¨ve seen how AI and digital processes boots both product quality and innovation. By analyzing consumer data, we can quickly tailor formulations, ensuring effectiveness and personalization. AI also speeds up development, allowing us to test and refine new ideas virtually it's the case of L´oreal Brandstorm"	"As a growth analyst, I can say that AI and digital processes have a significant impact on both the quality and innovation of product development. At Rappi, AI plays a crucial role in optimizing the entire product lifecycle, from market research and customer feedback analysis to real-time personalization, with AI we can analyze vast amounts of consumer data".	"I have over 20 years of experience in the tech industry, I can affirm that AI and digital transformation are instrumental in elevating both product quality and innovation. AI-driven data analytics empower us to conduct a deep analysis of consumer behavior, enabling us to anticipate market trends and develop products that are precisely aligned with consumer demands"

Pilar	Neha	Jonas	Mariana	Carlos
"As the Vice president of sustainability at The Estee Lauder Companies in Colombia, I believe that AI and digital processes are transforming the way we approach product development, particularly in terms of sustainability. AI enables us to optimize resource use by analyzing the supply chains."	"As a key account manager, the AI impact on product development and quality, managing customer expectations and tailoring offerings to meet specific needs. AI helps us analyze client data and market trends; this strengthens our relationship with key clients and ensures that the products we offer align with the latest market demands.	"I´ve been the product owner of Summer a Colombian startup, I can say that AI and digital processes have a significant impact on product quality and innovation. AI is a tool that streamlines on our product development cycles by automating repetitive tasks like testing, data analysis, and quality assurance, it accelerates the time for innovations and ensures high standards"	"As the Head of product innovation at Atenea, one of Colombia´s leading makeup brands, I see AI and Digital processes as essential to enhancing product quality and driving innovation. AI allows us to know consumer preferences. We can develop products that are highly personalized and responsive to evolving trends"	"I´ve been for 5 years the Chief Revenue Officer of Dapta, one of the most influential startups in Colombia, I believe that AI allow us to innovate faster while maintaining high-quality standards in our services. This level of insight enables us to personalize customer experience which directly improves customer satisfaction, leading to increased revenue."

Note: Own Construction

All interviewees were perfectly aware of several benefits of artificial intelligence, and that's notorious in the similar answers, it is consistently highlighted that AI improves product quality by enabling precise formulations, optimizing the supply chains, and automating testing processes. In this analysis, you can see the crucial role of personalization and it seems in the answers of the growth analyst and Rappi´s key account manager, they emphasized in AI´s ability to analyze consumer data and provide insights that enable companies to offer better products and services.

On the other hand, the sustainability insights from the vice president of the Estee Lauder companies underscore AI´s role in optimizing supply chain processes, reducing waste, and improving resource management that in the long term ensure sustainable growth. The answers support my research question by demonstrating how AI enables companies to align innovation with sustainability goals, ensuring responsible production.

Furthermore, the difference in perspective between roles in startups versus multinationals is noteworthy. In the case of the CEO of the startup and growth analyst focused on the agility and quick iteration AI provides, which is vital for startups. In comparison, corporate leaders like the Marketing chief and Vice president highlight the AI´s scalability and its role in driving sustainability.

4.2 How does the use of AI in the cosmetics industry affect data privacy and consumer perceptions of data security?

Table 2

Data Security

Violeta	Aron	Camilo	Angela	Diego
"The truth is that it has been a bit complicated to incorporate it 100% in VPro, people do not have confidence in these processes since in our country there is still a lot of education lacking in this regard, we always have in mind the great responsibility we have with the information of our clients, not only personal information	"I think AI enhances product personalization by using customer data, but it also raises privacy concerns. Since we rely on data to tailor products, we have to be extra cautious with how we handle that information. Consumers today are very aware of data security, and if they feel their information isn´t protected, it could damage trust in our brand"	"At L´Oreal, AI helps to personalize products by using customer data, but also impacts how consumers perceive data security. If customers don´t feel their data is being handled securely, trust in the brand can suffer. To maintain consumer confidence, we focus on transparency and strong privacy measures"	"I see AI improving personalization by analyzing customer data, but it also influences how consumers perceive data security. If they feel their data isn´t safe, trust in the brand can drop, which hurts growth. Ensuring strong data protection builds consumer confidence, driving engagement and loyalty."	"Trust is everything in this business, that's why we have taken it upon ourselves to take care of the relationship with clients. In our country it is very complicated to digitalize all the processes since it is very expensive and also due to the lack of knowledge, people do not trust leaving their personal data. It is true that it is a tool that

but processes, payments, purchases they have made, it is true that it has helped a lot in the follow-up and sales processes".				makes our lives easier, but it can also be a double-edged sword when it comes to having a relationship with clients."

Pilar	Neha	Jonas	Mariana	Carlos
" I see AI as essential for personalizing products and optimizing supply chains, but is also deeply affects consumers' perceptions of data security. We integrate AI responsibly by implementing robust data privacy protocols. Consumers are increasingly conscious of how their data is used.	"In my role, maintaining trust with clients means ensuring that we´re handling consumer data securely and transparently. If there´s any doubt or concern about data, can affect the entire relationship with the clients and consumers the data becomes a target for cyberattacks, and that is why we take high care	"In the cosmetic industry, we found a double-edged sword. AI allows us to offer personalized experiences, like customized skincare routines, but it also requires a lot of personal data. While AI helps us to innovate, we have to ensure robust data protection and be	"Honestly, I don´t know much about data privacy since I´m focusing on development but I how AI helps us to collect customers' data and with that we can create unique products, nowadays people are more conscious of data processes, so the company tries to be careful with that information.	" AI offers powerful tools for enhancing product offering and increasing revenue but also requires careful data security management to maintain the trust that fuels long-term business success. At Dapta, we´ve learned that building transparency around how we use AI and

		of the data in our company.	transparent about how we use that data.	ensuring robust data protection are essential to maintaining consumer trust.

Note: Own Construction

This question explore into a crucial aspect of AI-driven personalization, as personalization impact heavily on collecting and using consumer data. The effectiveness of AI in offering tailored products mount on consumers feeling comfortable with how their data is handled.

After reviewing and analyzing all the answers provided, several key points and distinctions emerged regarding how AI in the cosmetic industry affects data privacy and consumer perceptions of data security. A common theme across all perspectives is that AI enhances product personalization by leveraging customer data, but at the same time raises concerns about privacy and security. The product owner and the chief revenue officer emphasized that AI´s reliance on personal data requires careful handling to maintain customer trust.

Across all interviews the consumer's trust is a central issue, whether from the perspective of the Vice president of sustainability, the growth analyst and the CRO, all agree that mishandling customer data can lead to a significant erosion of trust, directly affecting brand loyalty and long term growth. This concern ties directly into my research question since it helps to differentiate between how small and large companies manage AI- related privacy challenges. Smaller companies may struggle with implementing strong privacy protections, which could limit their ability to capitalize on AI-driven personalization, while larger companies may have the resources to implement stronger safeguards.

4.3 In what ways do AI-powered tools improve or hinder product development and supply chain management in the cosmetics industry?

Table 3

Supply chain management

Violeta	Aron	Camilo	Angela	Diego
“ We found that AI helps us to optimize the relationship with our suppliers, it analyzes the supplier performance, costs, and lead time. It identifies the best suppliers based on data, ensuring a more reliable supply chain also, with quality control we can detect defects in products during the manufacturing processes.”	“ I can tell you that AI-powered tools have brought major improvements to both product development and supply chain management but I consider there are some challenges like high initial costs, implementing AI systems can be expensive for us, we have to balance the initial costs with the long-term benefits but	“In terms of supply chain management, AI has significantly improved our ability to forecast demand more accurately helping us reduce excess inventory and minimize waste. By analyzing sales trends, consumer behavior, and even external factors like seasonality. However, we face a challenge that is the talent need to manage	“AI allows us to innovate faster by analyzing customer data, helping us identify trend and customer preferences quicky. We can adjust out product lines to meet specific needs much faster than traditional methods, with these tools we can reduce time-to-time by 30%-50%, which is a game-changer for a	“I have no doubt that it improves all processes, but in terms of the supply chain it has been a huge help. We have been able to create much faster processes with our suppliers and clients. By digitizing many things we have improved our strategies and reduced costs, since the campaign budgets are clear.”

	these tools improve the supply chain management since we can create faster innovative processes".	and optimize these systems."	start-up where speed is critical for growth."	
Pilar	**Neha**	**Jonas**	**Mariana**	**Carlos**
"AI has an important impact on product development by enabling us to create more sustainable products. We can better predict the amount of stock required, preventing overproduction and reducing waste. It supports our sustainability goals like optimizing resources and creating eco-friendly products"	"it is essential in enhancing both I think, it allows us to quickly analyze customer data, enabling us to offer highly personalized products tailored to specific client needs. Also, the tools ensure we maintain efficient inventory levels, which are crucial for our limited resources."	"In supply chain management, AI enhances efficiency by predicting demand more accurately, reducing both overstock and stock shortages. At the beginning, the initial investment can be high but it helps us to develop personalized products for our clients and that is why we are one of the high-growth startups in Colombia."	"We can predict demand more accurately with AI. This has allowing us to create personalized makeup products to individual skin tones, formulas and textures, regarding the supply chain I don´t know much about the process in the company but in general, it changes a 100% the way we create our products."	"AI can helps balance the stock levels by predicting optimal inventory quantities, reducing the excess of stock and storqge costs, also algorithms can analyze historical data, seasonal trends an external factor; this help us to avoid overproduction and stockouts, ensuring the right product are available when needed"

Note:

One of the most consistent findings across all perspectives is the powerful impact of AI in personalization, for the Startup owner CMO and Product owner, AI enables the analysis of vast amounts of consumer data in real time, facilitating faster innovation and allowing brands to create tailored beauty solutions.

AI´s role in supply chain management is crucial nowadays, whether from the perspective of the growth analyst or the CMO, AI´s ability to improve demand forecasting, optimize inventory, and automate logistics is evident. This aspect is particularly significant for sustainable growth, as AI helps minimize waste, improve resource efficiency, and ensure products are available when needed without overproduction. The Vice-president perspective highlights how AI contributes to reducing environmental impact through better resource management.

However, several challenges were also consistently identified. These include high implementation costs, data dependency, and the complexity of managing AI systems. For startups, gathering the large datasets required to make AI effective is a key point, as mentioned by the Startup owner. In addition, the Vice-president of sustainability pointed out the energy consumption of AI systems and the need to mitigate their carbon footprint, which adds another layer of complexity when considering AI´s sustainability.

I can confirm with this question that AI-powered innovation in the cosmetics industry does indeed enhance personalized experiences by allowing for customized product offerings. Moreover, AI´s ability to optimize supply chains plays a key role in achieving sustainable growth through reduced waste, efficient inventory management, and better resources allocation, all the

answers consistently demonstrate that AI enhance both product development and supply chain management in ways that contribute to personalized experiences and sustainable growth.

Table 4

Ai integration

2.1. What is the financial impact of AI integration on small and medium-sized cosmetic businesses, particularly concerning initial investment and operational costs?

Violeta	Aron	Camilo	Angela	Diego
"The truth is that we were afraid to implement this technology in the company, it requires a very large team and also a team that knows how to handle it and adapt it to our needs, but thanks to that we have improved the teaching processes by 40% thanks to the good use of that, with artificial intelligence	"The upfront costs are often high, as implementing AI involves purchasing specialized software, setting up the necessary infrastructure, and hiring skilled professionals to manage these systems, there are ongoing operational costs that need to be managed, like constant updates, maintenance, and	"The impact of AI integration it's a vital initial investment in L´oreal, given the scale at which we operate. Implementing advanced AI systems requires significant resources for purchasing technology, upgrading infrastructure, and hiring specialized talent. On the operational cost side, maintaining AI systems demands continuous updates,	"I see the financial impact of AI integration in small and medium-sized businesses. The initial investment is typically one of the biggest hurdles, especially for smaller businesses, for a SME, this can be a substantial financial strain, especially since AI requires a lot of high-quality data to be effective. Better	"AI can significantly reduce costs over time.by enhancing data-driven decision making, AI optimizes marketing spend, ensuring we target the right customers with personalized content, which increases ROI on marketing campaigns. In customer retention and personalized experiences. AI tools allow is to create more

we were able to grow our catalog of services and also have competitive prices always adhering to our brand values such as the best products"	continuous data inputs to star effective"	model training, and process optimization. Since we are a large company, optimization help us to lower inventory carrying costs.	predictions lead to lower stock shortages or overstock situations, which is crucial for maintaining healthy cash flow."	tailored customer journeys, which build loyalty and increase the lifetime value of our customers."

Pilar	**Neha**	**Jonas**	**Mariana**	**Carlos**
"When it comes to operational costs, AI systems require ongoing maintenance, updates, and skilled management. By improving demand forecasting, AI helps us reduce overproduction, a common issue in	"For me AI integration is closely tied to its impact on client relationships and operational efficiency. In long-term financial benefits I believe the stronger relationships will increased the	"We need to invest in AI software, data collection tools, and the talent to manage all the systems, from a product development standpoint, AI is indispensable. It allows us to rapidly analyze	"I view AI integration as a game changer in our field, the operational costs remain an ongoing factor. Maintaining and upgrading AI infrastructure, training models, and ensuring data quality require	" My focus on AI integration revolves around its ability to directly impact revenue generation and overall financial performance, it allow us to optimize pricing strategies, automate customer

cosmetics. Consumers are increasingly choosing brands with a strong sustainability record. 65% of global consumers."	customer retention. The use of AI give us the opportunity to offer solutions that out clients may no get from the competitors"	consumer data, identify trends and develop personalized products the meet the needs."	consistent resources. AI can reduce development costs by 30-50% through faster iterations and optimized resources."	segmentation and forecast, a direct impact on profit margins by ensuring we have the right products it can reduce the cost by 20-40% in the industry"

Note:Own Construction

With this question I want to explore the financial challenges and benefits of AI in the cosmetics industry, from a personalization standpoint and marketing strategies, improving customer engagement and loyalty. The upfront costs of acquiring AI technology, building infrastructure and hiring skilled talent present a challenge for companies but the Chief revenues officer and the Vice president both emphasized that while these initial costs are high, they are critical for maintaining competitive advantage and supporting long-term growth:

Another views my interviewers take into account is the ongoing operational costs associated with AI, the Key account manager and the Head of product development mention that the costs including the maintaining and upgrading the systems for having precise data can be high but also they agrees that the operational efficiencies AI brings are better, like optimizing supply chain, reducing waste or improving customer personalization, in that way the CRO pointed out that AI´s ability to streamline processes and reduce aligns with long-term goals of both financial sustainability and environmental sustainability.

Also, there are some different points of view between how roles perceive AI integrations. For startups, as Aron emphasized, the high initial costs and challenges of accessing quality data are significant barriers, in the case of small businesses they must carefully manage these investments to avoid financial strain, unlike big companies like Lóreal or The Estee Lauder Companies, which have more resources to absorb these costs.

By acknowledging the challenges of AI integration, such as the high costs and data dependencies, the insights from Aron (Startup owner) and the growth analyst add depth to my research. Their answers show that while AI offers clear benefit, it also presents obstacles that companies must carefully consider, especially for small businesses.

Table 5

Innovation

4.4 In your perspective, how the integration of AI in your Beauty Tech business influences the ability to compete in the market with innovation?

VIOLETA	ARON	CAMILO	ANGELA	DIEGO
"Well, i believe it would be reflected in speed, agility, ideas and in offering more cost-effective products or services. For example, in something that used require 30 employees can be reduce to just 15 through automation, also the cost impact would be very noticeable in the processes in all areas, we can be more effectiveness and be one step	"I think that every company will need to have as the bare minimum, all these tools available for the processes, nowadays when a person has experienced a fully digital process you can´t offer less. That's why in this industry the best ones are the	"the integration of AI in the business has fundamentally strengthened out market positions by enabling deeper personalization and faster innovation cycles, L´oreal is one of the most powerful beauty hubs in the work and we are pioneers in the beauty tech industry, creating	"AI empowers us to respond quickly to changing beauty trends, by creating more agile product development process. For example, we use machine learning algorithms that allow us to adjust product formulation or even suggest new products	"Our adoption of AI- powered virtual try-on tech has drastically change how consumers interact with our products, offering a hands-on experience with our products. This technology allows customers to test

ahead with all the trends and products the customers are looking."	ones that are working always with new technologies that can provide new information and innovation and with that create unique products or services."	products and services that change the beauty that we know."	in response to trend, often in half of the time it take us several years ago, this lead us to be top one startup in Colombia and having the customer satisfaction and loyalty we been working on."	different shades, textures and styles virtually in the BTL activation we normally do for study the consumer behavior before launching a product, and thanks to that we can target the correct niche for our company"

Pilar	Neha	Jonas	Mariana	Carlos
"AI has allowed us to integrate sustainable practices mor effectively into out manufacturing processes, which is a significant market	"By using AI we have increased product development through consumer insights, unique needs and preferences, which is	"AI allows us to refine our marketing strategies by creating predictive analytics. We can identify purchasing patterns,	" I believe AI has given us an advantage in the market, we are early adopters that with AI we can automates repetitive tasks like inventory	" I understand that its crucial to make informed revenues focused decision and AI help us by analyzing customer

differentiator. We have work to improve our supply-chain tools so we can predict more accurately the demand, thanks to that we reduce overproduction and waste. Additionally, we use AI in material sourcing and formulation, enabling us to select ingredients that meet high sustainability standards.	especially impactful in the beauty industry where personalization drives loyalty, we can analyze the customer data on a precise level, from skin tone and texture to lifestyle preferences. We have reached a 40% of reduction in product launch times, this speed and precision in tailoring products give us the power to set the trends and be the first in the markets.”	forecast trends and create hyper-targeted campaigns, with AI we can optimize conversion rates and know how to work with our audience, its crucial these technologies in the company to ensure we are giving the best of the best in products.”	management, customer segmentation and some aspects of the product development, thanks to that we can focus in creating what the customers wants in speed and high quality processes, also we innovate in project and in new products without compromising operational efficiency.”	behavior and forecasting demand as I mentioned previously the supply chain its also one of our key points I we can reduce the operational costs by up to 30% and that is good for us since we can increase out profit margins.”

Note: own construction

Basically, the main point of view of all the interviewees is that the early adopters are the ones dominating the industry. All the professionals' highlights AI´s strategic role in helping companies to maintain a competitive edge in the fast-paced cosmetic industry. This question is related to my research since it captures the essences of AI´s impact on innovation and customer engagement and how all the key insights drive to long-term success in the sector.

AI´s capability to drive personalized customer experience directly contributes to market differentiation and customer loyalty. Also, it improves the supply chain processes of the companies that know how to be used, these efficiencies lead to cost savings and allow companies to reallocate resources toward innovative projects and further strengthen their marketing position.

Its clearly that customers are becoming more and more digital, in their minds this and added value that makes reasonable to choose one company over another company, to choose a beauty tech over a big traditional company, the interviewers have very clear that they must face different barriers to remain competitive, it was very clear that everyone have a similar point of view regarding this question and the expertise they have in the industry give a boost to this part of my research since they know how to identify future trends and what customers wants.

Future growth in the cosmetics industry

4.5 How do you see AI driving future growth in the cosmetics industry, and what areas should companies focus on to remain competitive?

Violeta	Aron	Camilo	Angela	Diego
"I see AI as an essential driver for the future growth of the cosmetic industry especially in education and skill building within the field. It offers unique ways to customize learning experiences for students, helping them master techniques to focus in the clients needs. To stay competitive, I	"I believe AI will drive substantial future growth in the cosmetic industry by creating hyper-personalized marketing and content creation this can allow brands to create targeted, dynamic content that resonates with specific audience segments. I think cosmetics companies should focus on	"Future growth is here, particularly in enhancing our ability to stay relevant and connected to consumers in real time. AI enables us to better understand and anticipate consumer needs, providing insights into trends across diverse segments and markets. One of the most	"As a growth analyst I understand how AI connect with customers and create highly personalized products. With the algorithms we can develop innovation cycles, the speed in go to market its everything we can respond quickly to beauty trends, I believe that beauty tech companies need to continually invest in AI to stay competitive,	" It is essential for driving future growth, particularly through personalized interactions, this level of customization is crucial for fostering deeper engagement and loyalty, we has increased up to 15% the revenues through better conversion rates and higher customer satisfaction. This ensures

believe companies should focus on developing AI-driven tools that can analyze market data to predict beauty trends before they peak."	leveraging AI for real-time content creation and automated trend analysis, the sustainable content practices such as reducing digital waste by optimizing content for efficiency."	powerful aspects is its capacity for predictive analysis, with ML we can analyze past purchasing behaviors and emerging beauty trends to forecast demand."	especially as consumer expectations for personalization, speed and sustainability increase.	that our marketing is both timely and relevant, maximizing ROI."

Pilar	**Neha**	**Jonas**	**Mariana**	**Carlos**

“I believe that AI is a transformative force in driving sustainability growth across the beauty industry, it facilitates sustainable product innovation, we can analyze raw material for the environmental impact and choose alternatives that are both effective and eco-friendly. In the future we want to focus more in the tracking of the journey or out ingredients, from their origin to the final product.	“ it is a game changer in managing and enhancing our most critical client relationships, by utilizing AI tools, we gain a precise understanding of each client’s needs, preferences and purchasing trends.AI help us to provide out clients with valuable market insights and predictive analytics, I know that in a early future the industry its going to be dominating by beauty tech companies since they know what consumers wants.”	“AI is an indispensable tool for driving product innovation and meeting consumer demands with precision and speed, traditionally product formulation and testing cycles are lengthy, but with AI we can simulate and optimize these processes faster, reducing development time significantly,	“I see AI as a revolutionary force that´s reshaping the entire beauty industry. Through machine learning and data analysis, we are now able to create hyper personalized products and recommendations. Also supports sustainability in ways that feel both impactful and responsible.”	“I view AI as a key driver of future revenue growth, with a strategic impact on both our competitive positioning and our ability to capitalize on emerging market trends. From a competitor standpoint, AI provides a significant advantage by allowing us to respond faster that competitors to change in consumer preferences.”

Table 6. future growth in the cosmetic industry, own construcion

Across all the answers, AI's role in personalization and customer experience is one of the main points in the future, they emphasize in how AI has boosts the levels of personalization in others ways, from virtual skin to tailored product recommendations. This value propositions its crucial in the future since mostly all the companies will have access to the technologies the company need to have very clear why they are different between the competence.

According to research, brands that effectively use personalization can increase the revenue by 5- 15% and build a strong consumer loyalty, one key point in being relevant in the market since the future focused companies will invest more and more in technologies like AI to help they creating better products, experiences, processes and at the same time having a better understanding of the new trends and consumers.

With this question I want to show how AI is a core element in transformation of the cosmetic industry and how it can provides a roadmap for companies that are looking for success in sustainability and growth in our country, it was very clear the areas where AI can help brands not only meet but exceed market expectations; by focusing on hyper personalization, operational agility and sustainable growth.

5. Conclusions and recommendations

Throughout this thesis, the insights recollected from the responses of the ten professionals who work in different beauty companies and startup have shown key aspects of the cosmetic industry, demonstrating how AI-powered advancement drive customization, productivity, and sustainable growth. From all the information gathered, AI allows cosmetics companies to predict trends, react quickly to customers needs, and create personalized customer experiences. These is crucial in the sector where customers tastes change quickly.

The integration of AI technologies in the cosmetic industry shows notable benefits, including more efficient products creation, improved interaction with customers, and decreased environmental harm. All the responders consistently highlighted that utilizing AI for personalization and trend analysis enables companies to generate value by meeting individual preferences on a large scale; furthermore, AI helps companies improves efficiency in forecasting demand and managing supply chains, leading to resource optimization and waste reduction, which aligns with the industry's move towards to sustainability.

Even though all the benefits, some obstacles still exit, especially in new startups or beauty tech companies. Limitations like expensive starting expenses, intricate data handling, and the necessity for skilled expertise can impede complete AI implementation. Additionally, it is important to focus on ethical issues surrounding data privacy within AI algorithms to uphold consumers trust and promote fair results. The findings were conclusive in determining that consumer wants personalized makeup products, experiences and with that have loyalty with a brand and buy their products every time they want.

Unfortunately, it was not possible to get a lot of data driven to sustainability since the only interviewee that has experiences in sustainability processes was the Vice-president of the Estee lauder Companies in Colombia, on the other hand all the participants give good insights for the research and possibles solutions that the industry can start taking into account to achieve sustainable growth in the early future.

The findings in this study will help me to create my own beauty tech company, one of my goals of doing a master in luxury marketing and brand management is to have the tools to create opportunities to the people, it would help me to understand what the market its looking for and how with AI the industry can be revolutionizing. As I mention in my research this industry is going to continue in exponential growth and with good use and understanding of artificial intelligence, virtual- try on and consumer satisfaction will change the way we perceive makeup.

6. Bibliography

Attila, E., Yuling, W., Tamas, G., Jhanghiz, S. (2022). *The E-WOM intention of artificial intelligence (AI) color cosmetics among Chinese social media influencers*. Recovered the 22 of may 2022, from Emerald website: https://www.emerald.com/insight/content/doi/10.1108/APJML-04-2022-0352/full/html

Bäckerås, J. (2019). *What do skin care consumers think about personalization of content, user interface or a combination of both?*. Recovered the 04 of November of 2019, from University of Gothenburg website: https://gupea.ub.gu.se/handle/2077/62614

Babatunde, A. O., Adedoyin, F. F., & Olubunmi, A. O. (2024). *Journal of Technology and Customer Interaction.* Recovered the 14 of march of 2024, from Artificial intelligence and the future of customer engagement in the cosmetic industry 45-62 website: https://fepbl.com/index.php/ijmer/article/view/964

Borunda, A. (2019). *The beauty industry generates a lot of plastic waste. Can it change?*. Recovered the 28 of January of 2019, from National geographic Environment website: https://www.nationalgeographic.com/environment/2019/04/beauty-personal-care-industry-plastic/

Ernest, M. (2022). *Gucci partners with roblox to launch 'guccitown' metaverse world.* Recovered the 20 of June of 2022, from Inputmag website: www.inputmag.com/style/gucci-roblox-metaverse-world-gucci-town

Ganga, B.M., Meghana, K.S., Shivani, S.R., Spandana, M.K., & Vinutha, V. (2022). *ACS Journal for Science and Engineering.* Recovered the 03 of September of 2022, Sentimental analysis on cosmetics using machine learning website: https://scholar.google.com/scholar?hl=es&as_sdt=0%2C5&q=Sentimental+analysis+on+cosmetics+using+machine+learning&btnG=

Hapticmedia. (2021). *Virtual try-on: the next big thing in luxury business*. Recovered the 27 of May of 2021, Hapticmedia website: https://hapticmedia.com/blog/virtual-try-on/

Joy, A., Zhu, Y., Peña, C., & Brouard, M. (2022). *Digital future of luxury brands: Metaverse, digital fashion, and non-fungible tokens.* Recovered the 07 of April of 2022, from Strategic Change website: https://doi.org/10.1002/jsc.2502

Jiao, Y., Liu, P., & Chen, C. (2022). *Current and prospective applications of 3D printing in cosmetics*. Recovered the 13 of January of 2022, from Magazine Cosmetics website: https://www.mdpi.com/2079-9284/9/6/115

Kestenbaum, R. (2019). *The future of retail in the beauty industry will be very different.* Recovered the 29 of October of 2019, from Forbes website : https://www.forbes.com/sites/richardkestenbaum/2019/09/04/the-future-of-retail-in-the-beauty-industry-will-be-very-different/#4b1f35c76c4f

L'Oréal | *Annual Report – Social & environmental performance*. (2024). L'Oréal Finance website: https://www.loreal-finance.com/en/annual-report-2023/social-environmental-performance/

Li, B., Hou, B., Yu, W., Lu, X., & Yang, C. (2017). *Applications of artificial intelligence in intelligent manufacturing.* Recovered the 02 of September of 2017, from Frontiers of Information Technology & Electronic Engineering website: https://doi.org/10.1631/fitee.1601885

Martins, M. (2019). *The impact of influencers in the consumer´s purchase intention*. Recovered the 20 of June of 2019, from the cosmetic industry website: https://core.ac.uk/download/pdf/542331719.pdf

Moreira, C. (2020). *How artificial intelligence impacting the beauty industry on making data-diven decisions?*. Recovered the 2020, from Repositorio AbertoUP website: https://repositorio-aberto.up.pt/bitstream/10216/129490/2/423899.pdf

Michel, W, Julie, C. (2002). *Difference in purchase behavior between France and the USA: the cosmetic industry.* Recovered the 22 of June of 2002, from Emerald website:

https://www.emerald.com/insight/content/doi/10.1108/13612020210448673/full/html

Metaxiotis, K., Ergazakis, K., Samouilidis, E., & Psarras, J. (2003). *Decision support through knowledge management: the role of the artificial intelligence.* Recovered the 12 of

December of 2003, from Information Management & Computer Security, 11(5), 216–221 website: https://doi.org/10.1108/09685220310500126

Niinimäki, K. (2017). *Sustainable consumer satisfaction in the context of clothing.* Recovered the 03 of June 2017, From Routledge eBooks (pp. 218–237) website: https://doi.org/10.4324/9781351278003-7

Rayome, A. D. (2018). *How Sephora is leveraging AR and AI to transform retail and help customers buy cosmetics*. Recovered the 17 of May of 2018, from Revista techrepublic, 30 website:https://www.techrepublic.com/article/how-sephora-is-leveraging-ar-and-ai-to-transform-retail-and-help-customers-buy-cosmetics/

Shah-Dand, M. (2021). *What does AI mean for Sustainability? - DataDrivenInvestor*. Recovered the 25 of September of 2021, from Medium website: https://medium.com/datadriveninvestor/what-does-ai-mean-for-sustainability-4623e53f1ce2

Santos, S., & Gonçalves, H. M. (2021). *The consumer decision journey: A literature review of the foundational models and theories and a future perspective.* Recovered the 30 of July of 2021, from Technological Forecasting and Social Change, 173, 121117 website: https://doi.org/10.1016/j.techfore.2021.121117

Tilters. (2021). *Personalized Customer Journeys and Technology trends*. Recovered the 20 of March of 2021, from The Tilt Publishing website: http://www.econtentmag.com/Articles/Editorial/Industry-Insights/8-Technology-Trends-Enabling-the-Future-of-Personalized-Customer-Journeys-132890.htm

Wang, Y., Chuang, Y., Hsu, M., & Keh, H. (2003). *A personalized recommender system for the cosmetic business.* Recovered the 21 of November of 2003, from Expert Systems with Applications website:https://www.sciencedirect.com/science/article/pii/S0957417403001738

Yoon, J., & Joung, S. (2020). *A big data-based cosmetic recommendation algorithm*. Recovered the 19 of June 2020, from Journal of Information and Communication Convergence Engineering, 10(2), 3-12 website:

https://scholar.google.com/scholar?hl=es&as_sdt=0%2C5&q=A+big+data-based+cosmetic+recommendation+algorithm&btnG=