VILNIUS UNIVERSITY
BUSINESS SCHOOL

DEEPTECH ENTREPRENEURSHIP PROGRAMME

Emilija Dikčiūtė

THE FINAL MASTER'S THESIS

SOCIALINĖ KOMERCIJA KAIP STRATEGINĖ KOMERCIALIZAVIMO KRYPTIS GILIŲJŲ TECHNOLOGIJŲ SVEIKATOS IR GROŽIO SEKTORIAUS STARTUOLIAMS	***SOCIAL COMMERCE AS A STRATEGIC COMMERCIALIZATION DIRECTION FOR DEEP-TECH HEALTH AND BEAUTY STARTUPS***

Supervisor

Robertas Skliaustas, Junior researcher

Name, surname, academic title, scientific degree

of the supervisor

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SUMMARY IN ENGLISH

VILNIUS UNIVERSITY BUSINESS SCHOOL
DEEPTECH ENTREPRENEURSHIP STUDY PROGRAMME
EMILIJA, DIKČIŪTĖ

SOCIAL COMMERCE AS A STRATEGIC COMMERCIALIZATION DIRECTION FOR DEEP-TECH HEALTH AND BEAUTY STARTUPS

Supervisor – Junior researcher, Robertas Skliaustas
Master's thesis (project) was prepared in Vilnius, in 2025
Scope of Master's thesis (project) – 99 pages.
Number of tables used in the FMTP – 6 pcs.
Number of figures used in the FMTP – 18 pcs.
Number of bibliography and references – 246 pcs.

The FMTP described in brief:

This master's thesis explores how social commerce platforms can serve as strategic tools for the commercialization of deep-tech startups in the health and beauty sectors. The study focuses on how social commerce functionalities such as content creation, community interaction, and platform-based engagement can support market entry, brand visibility, and customer relationships of deep-tech beauty and health startups. Today's rapid digitalization and rise of social commerce are reshaping how innovative products are commercialized and introduced to the market, particularly in sectors as health and beauty. At the same time, deep-tech startups in these sectors face persistent challenges in translating innovative scientific innovations into market-ready solutions. It further examines how specific features of social commerce platforms can address these challenges.

Problem statement: Deep-tech startups operating in the health and beauty sectors face distinct commercialization challenges arising from technological complexity, long development cycles, regulatory constraints, and limited consumer awareness. These factors make it difficult for startups to communicate value propositions to non-technical audiences and to establish consumer trust. Although social commerce platforms have become increasingly influential in shaping consumer behavior and purchasing decisions, there is limited empirical and strategic guidance on how these platforms can be effectively utilized to support the market entry and growth of deep-tech startups. This lack of structured understanding represents a significant gap that this thesis seeks to address.

The objective of this thesis is to examine how social commerce can function as a strategic pathway for the commercialization of deep-tech startups in the health and beauty sector.

Research tasks include:

1. Systemizing the challenges and limitations deep-tech startups face in marketing and commercialization, particularly in health and beauty sectors.

2. Examining the key characteristics and functionalities of social commerce platforms that can address these challenges.
3. Analyzing real-world examples of deep-tech startups that have successfully utilized social commerce.
4. Evaluating the influence of social platform features on consumer engagement, trust-building, and brand visibility.
5. Developing a strategic framework to support the use of social commerce for accelerating growth and market entry of deep-tech startups in beauty and health sector.

Research methods: The study employs a mixed-methods approach, including a literature review, analysis of real-world startup case studies, and a quantitative online public survey.

Research and results obtained: The research identified key commercialization challenges for deep-tech startups, such as long development cycles, limited funding, and low consumer trust. Case studies showed that startups successfully using social commerce through influencer partnerships, educational content, and platform tools and build visibility and trust effectively. Survey results confirmed that consumers are more likely to notice, trust, and consider purchasing deep-tech health and beauty products when they are promoted through engaging content on platforms like TikTok, Facebook and Instagram.

Conclusions of the FMTP:

1. Deep-tech startups in health and beauty sectors face barriers like long development, high costs, and low consumer awareness.
2. Social commerce platforms offer effective tools to simplify communication and build trust with users.
3. Case studies show that startups using influencers, educational content, and interactive features gain stronger visibility and engagement.
4. Survey results confirm that consumers are more likely to trust and consider deep-tech products seen on social media.
5. A clear, strategic use of social commerce helps startups reach the market faster and grow their customer base.
6. The strategic framework has been developed based on the findings addressing the gap between innovative deep-tech products and their communication to consumers.

SUMMARY IN LITHUANIAN

VILNIAUS UNIVERSITETAS, VERSLO MOKYKLA
AUKŠTŲJŲ TECHNOLOGIJŲ VERSLAS , STUDIJŲ PROGRAMA
EMILIJA, DIKČIŪTĖ

SOCIALINĖ KOMERCIJA KAIP STRATEGINĖ KOMERCIALIZAVIMO KRYPTIS GILIŲJŲ TECHNOLOGIJŲ SVEIKATOS IR GROŽIO SEKTORIAUS STARTUOLIAMS

Vadovas – jaunesnysis tyrėjas, Robertas Skliaustas
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Trumpas darbo aprašymas:

Šiame magistro darbe nagrinėjama, kaip socialinės komercijos platformos gali veikti kaip strateginiai įrankiai giliųjų technologijų startuolių komercializavimui sveikatos ir grožio sektoriuose. Tyrime analizuojama, kaip socialinės komercijos funkcionalumai, tokie kaip turinio kūrimas, bendruomenės sąveika ir platformomis grįstas įsitraukimas, gali padėti giliųjų technologijų grožio ir sveikatos startuoliams patekti į rinką, didinti prekės ženklo matomumą ir kurti santykius su vartotojais. Sparčiai vykstanti skaitmenizacija ir auganti socialinės komercijos reikšmė keičia inovatyvių produktų komercializavimo ir pateikimo rinkai būdus, ypač tokiuose sektoriuose kaip sveikata ir grožis. Tuo pačiu metu giliųjų technologijų startuoliai šiuose sektoriuose susiduria su nuolatiniais iššūkiais, bandydami paversti sudėtingas mokslines inovacijas rinkai paruoštais sprendimais. Darbe taip pat nagrinėjama, kaip konkretūs socialinės komercijos platformų elementai gali padėti spręsti šiuos iššūkius.

Problema: Giliųjų technologijų startuoliai, veikiantys sveikatos ir grožio sektoriuose, susiduria su komercializavimo iššūkiais, kylančiais dėl technologinio sudėtingumo, ilgų kūrimo ciklų, reguliacinių apribojimų ir riboto vartotojų informuotumo. Šie veiksniai apsunkina produkto vertės perteikimą netechninei auditorijai bei vartotojų pasitikėjimo kūrimą. Nors socialinės komercijos platformos tampa vis svarbesnės formuojant vartotojų elgseną ir pirkimo sprendimus, vis dar trūksta empirinių ir strateginių gairių, kaip šias platformas galima efektyviai panaudoti giliųjų technologijų startuolių patekimui į rinką ir augimui skatinti. Šis struktūruoto supratimo trūkumas sudaro reikšmingą tyrimų spragą, kurią siekiama užpildyti šiame darbe.

Šio darbo tikslas – ištirti, kaip socialinė komercija gali būti strateginis sprendimas giliųjų technologijų startuolių komercializacijos sveikatos ir grožio sektoriuje.

Užduotys:

1. Susisteminti giliųjų technologijų startuolių rinkodaros ir komercializavimo iššūkius ir apribojimus, ypač sveikatos ir grožio sektoriuose.

2. Išnagrinėti pagrindines socialinės komercijos platformų savybes ir funkcijas, kurios gali padėti išspręsti šiuos iššūkius.
3. Nustatyti ir išanalizuoti realius giliųjų technologijų startuolių, sėkmingai naudojančių socialinę komerciją, pavyzdžius.
4. Įvertinti, kaip socialinės platformos funkcijos veikia vartotojų įsitraukimą, pasitikėjimo kūrimą ir prekės ženklo matomumą.
5. Sukurti strateginę sistemą, kaip giliųjų technologijų startuoliai gali naudoti socialinę komerciją, kad paspartintų augimą ir patekimą į rinką.

Naudoti tyrimo metodai: Tyrime buvo taikytas mišrus metodas, įskaitant literatūros apžvalgą, realių startuolių atvejų analizę ir kiekybinę apklausą internete.

Tyrimas ir gauti rezultatai: Tyrimas nustatė pagrindinius giliųjų technologijų startuolių komercializavimo iššūkius, tokius kaip ilgi kūrimo ciklai, ribotas finansavimas ir mažas vartotojų pasitikėjimas. Atvejų tyrimai parodė, kad startuoliai sėkmingai naudoja socialinę prekybą per influencerių partnerystes, edukacinį turinį ir platformų įrankius bei efektyviai kuria matomumą ir pasitikėjimą. Apklausos rezultatai patvirtino, kad vartotojai labiau linkę pastebėti, pasitikėti ir apsvarstyti galimybę įsigyti giliųjų technologijų sveikatos ir grožio produktus, kai jie reklamuojami įtraukiančio turinio pagalba tokiose platformose kaip „TikTok“, „Facebook“ ir „Instagram“.

Darbo išvados:

1. Giliųjų technologijų startuoliai sveikatos ir grožio sektoriuose susiduria su kliūtimis kaip ilgas kūrimo laikas, didelės išlaidos ir mažas vartotojų informuotumas;

2. Soc. komercijos platformos siūlo veiksmingas priemones, skirtas supaprastinti bendravimą ir sukurti ryšį su vartotojais;

3. Atvejų analizės rodo, kad startuoliai, naudojantys nuomonės formuotojus, edukacinį turinį ir interaktyvias funkcijas, įgyja didesnį matomumą ir įsitraukimą;

4. Apklausos rezultatai patvirtina, kad vartotojai labiau linkę pasitikėti giliųjų technologijų produktais, matomais socialinėje žiniasklaidoje, ir apsvarstyti jų įsigijimą;

5. Aiškus, strateginis socialinės komercijos naudojimas padeda startuoliams greičiau pasiekti rinką ir padidinti klientų bazę;

6. Sukurta strateginė struktūra sprendžianti atotrūkį tarp inovatyvių giliųjų technologijų produktų ir jų komunikacijos su vartotojais problemą.

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INTRODUCTION

Subject Matter of Research

Social commerce represents a new genre in e-commerce that emerges at the intersection of social media and Web 2.0 technologies (Leong et al., 2024), fundamentally differing from traditional e-commerce by enabling users to shop without having to leave social media applications, such as TikTok Shop, Instagram Shopping, and others. These platforms combine product discovery, user-generated content, algorithm-driven recommendations and interactive shopping features (such as shoppable videos and livestreams), fostering trust and spontaneous buyer behavior among consumers.

The global social commerce market size was estimated at USD 1.16 trillion in 2024 and is projected to reach USD 17.83 trillion by 2033 (Lee, 2025). The growth is largely driven by younger consumers, who value authenticity, peer recommendations, creators and effortless mobile shopping experiences (Farooque et al., 2025). This makes social commerce not just a sales channel, but also a powerful tool for building trust, visibility, and emotional connection between businesses and consumers. (Alkhalifah, 2022; Laradi et al., 2024; Lu et al., 2016).

For deep-tech start-ups especially those originating from scientific research or laboratories commercialization often presents major challenges. In the article “Marketing for Deep Tech Startups”, Supriya Agarwal – a recognized voice in deep-tech commercialization – highlights the need to simplify messaging and carefully target niche audiences, addressing the gap that many deep-tech start-ups have in modern marketing and consumer communication channels. In this context, social media platforms offers a solution by enabling targeting of niche audiences through algorithm-driven content and advertising systems (Duan, 2025; Gerbaudo, 2024), while also functioning not merely as entertainment platforms but as integrated commercial ecosystems(Azad Moghddam et al., 2024; M. G. Brown et al., 2024). Social platforms like TikTok, Instagram are no longer used only for entertainment or personal networking. They have evolved into commercial ecosystems. TikTok has become a key player in the health and beauty industry (Al Rabea et al., 2023; Zhang, 2024).

The beauty and health industry has been one of the quickest to embrace social commerce, largely because it thrives on trust, peer recommendations, and visually rich content. This rapid success came from consumers' reliance on authentic user-generated testimonials and influencer endorsements to mitigate risks in personal care purchases. Also, consumers often develop a strong sense of closeness to influencers and watching them sharing of their personal skincare routines or health experiences fosters deeper emotional involvement and trust(Duan, 2025). Social media has reshaped how people come across new products and evaluate them and ultimately decide what to buy or not. In this sector, trends often spread at remarkable speed, fueled by short-form videos (reals), influencer partnerships, and interactive tutorials that make products feel both accessible and relatable. (Al Rabea et al., 2023; Zhang, 2024). Notably, deep-tech innovation in this sector is evident

in the emergence of AI-powered skin analysis apps, personalized beauty and wellness routines driven by machine learning, and at-home devices using advanced diagnostics or biotechnology – such as genetic testing kits, non-invasive skincare devices, and personalized supplement recommendations powered by data science (Hasan, 2025; Penelitian et al., 2025; Starzyk et al., 2025) . Social commerce platforms like TikTok seem like critical channels for launching and scaling these deep-tech products enabling start-ups to educate and engage consumers through interactive demos, real-time feedback, and peer-driven conversations that demystify complex technologies and build trust (Starzyk et al., 2025; Zhang, 2024). This integration of deep-tech and consumer engagement marks a significant transformation in the health and beauty industry, where scientific innovation is increasingly commercialized via relatable and socially immersive digital experiences (Al Rabea et al., 2023; Starzyk et al., 2025).

This research focuses on the potential of social commerce as a strategic tool for the growth and commercialization of deep-tech start-ups, with a particular emphasis on the health and beauty sector and platforms like TikTok and Instagram. It investigates whether and how these start-ups can effectively leverage social commerce to overcome common limitations in marketing and consumer outreach, exploring the role that social platforms play in the commercialization process and how AI-driven tools can help build scalable and adaptive digital strategies.

Scientific Problem

Despite the rapid growth of social commerce and its widely recognized impact on direct-to-consumer interactions, existing research has surprisingly overlooked how deep-tech start-ups that emerge from scientific research or laboratories can effectively leverage the unique capabilities of social commerce platforms (Hu, 2024). Most social commerce studies have concentrated on mainstream brands or consumer products, focusing primarily on influencer marketing, peer recommendations, or how platform shopping tools work in traditional retail (Capatina et al., 2024; Kask & Linton, 2025). This creates a clear knowledge gap around how companies with complex, deep-tech products – which typically lack consumer marketing expertise and established communication channels – might adapt their commercialization strategies for social commerce environments (Dwivedi et al., 2021; Guo & Li, 2022; Hu, 2024). Very few studies have examined the specific challenges and opportunities that commerce creates for these ventures, especially in rapidly evolving sectors like health and beauty, where product discovery and consumer trust are crucial.

The main scientific problem addressed in this research is the lack of comprehensive understanding and evidence-based strategies for how deep-tech start-ups can effectively leverage social commerce platforms (Capatina et al., 2024) – such as TikTok and Instagram, to overcome commercialization barriers, communicate complex innovations to non-technical audiences, and achieve scalable growth in sectors like health and beauty.

Novelty and Relevance of the Research

This research introduces a new perspective by connecting deep-tech start-up commercialization with the growing field of social commerce.

The novelty of the research is demonstrated in the following ways:

- This research explores how deep-tech start-ups, especially in the health and beauty sector, can use social commerce platforms like TikTok and Instagram to commercialize their products.
- Known research methods (case studies and surveys) are applied to a new context – social commerce strategies used by deep-tech start-ups.
- Most existing studies focus on influencer marketing or advertising outcomes (Guo & Li, 2022). This thesis shifts the attention to the strategic role of social commerce in supporting deep-tech start-up market entry, early user attraction, and build scalable commercialization strategy.
- Original data from real-world start-up cases and user surveys is used to confirm, question, and extend current understanding of how deep-tech ventures can reach consumers through social platforms.

Research Objective

The objective of this thesis is to examine how social commerce can function as a strategic pathway for the commercialization of deep-tech startups in the health and beauty sector.

To achieve this, the study will pursue the following specific objectives:

1. Systemize the challenges and limitations deep-tech startups face in marketing and commercialization, especially in health and beauty sectors.
2. Examine key characteristics and functionalities of social commerce platforms, with a focus on TikTok and Instagram that acknowledge identified challenges and limitations of deep-tech startups.
3. Identify and analyze real-world examples of deep-tech startups that have successfully engaged with social commerce environments using insights from the literature review and survey.
4. Evaluate how social platform features influence consumer engagement, trust-building, and brand visibility in deep-tech product promotion.
5. Provide strategic framework outlining how deep-tech startups can use social commerce platforms to drive growth and accelerate market entry and commercialization.

Research Methods

Table 1 Research Methods

Systematic Analysis of Scientific Literature	Used to review and analyze existing academic research on social commerce, deep-tech commercialization, AI and platform-based business strategies. This provides a theoretical foundation and highlights gaps in current research.

Case studies	The case studies in the thesis used to present real-world examples of deep-tech startups in the health and beauty sectors that have successfully leveraged social commerce strategies to overcome commercialization challenges and build consumer trust.
Quantitative Research	Surveys and data analysis in this thesis examine how social commerce platforms features such as influencer content, interactive formats, and platform-based engagement tools affect consumer engagement, trust-building, and brand visibility in the context of deep-tech health and beauty products. The survey gather data on user behavior, preferences, and attitudes, toward social commerce platforms.

Scientific and practical benefits

This research brings new insight into how deep-tech innovations can be translated into real-world products using social platforms. It combines ideas from innovation studies, digital marketing, and platform economics to explore how scientific startups can better connect with everyday users. By focusing on tools like TikTok's algorithms or Instagram's shopping features, the research shows how complex technologies can be made accessible through engaging, data-driven content. On a practical level, the research gives deep-tech founders clear strategies to market their products without big budgets or traditional retail channels. It highlights how social commerce can help deep-tech startups explain what they do, build trust quickly, and reach early customers – especially in fast-moving sectors like health and beauty.

The structure of the work

This research introduces the research context and gap, reviews literature on deep-tech startups and social commerce, explains the mixed-methods methodology, presents empirical findings from case studies and surveys and concludes with key insights and recommendations for industry practice.

Practical applicability and reliability of the research results obtained

The research presented in this thesis has strong practical applicability, particularly for deep-tech startups operating in the health and beauty sectors. By combining theoretical analysis with real-world case studies and original public survey data, study offers actionable insights into how social commerce can be strategically used to overcome commercialization barriers. The selected startups demonstrate concrete examples of how platform tools, influencer partnerships and educational content can improve visibility, trust, and market entry success. Additionally, the survey results provide direct consumer perspectives, confirming the effectiveness of social media features in shaping purchasing decisions. Reliability of findings is supported by a structured research methodology, including clearly defined variables, well-chosen sample group and consistency between quantitative

data. These elements ensure that the research conclusions are grounded, credible and relevant for academic study and practical implementation by early-stage deep-tech start-ups.

Brief identification of the difficulties and limitations

One of the main difficulties encountered during this research analysis was the limited availability of publicly disclosed data from deep-tech startups, as many early-stage companies do not share detailed marketing or commercialization strategies. This made it challenging to compare performance outcomes across different cases.

While the survey provided valuable insights the number of participants could have been higher to ensure more accurate and generalizable results. One specific goal of the survey was to reach as many male respondents as possible, since previous studies focused mainly on female consumer behavior. The target was a 50/50 gender balance, but this survey reached a ratio of 41% men and 59% women. It is also important to note that the survey was conducted mostly in Lithuania, so the responses primarily reflect the behaviors and preferences of Lithuanian consumers, which may differ from trends in other markets.

Another limitation is the rapidly evolving nature of social media platforms – features and algorithms change frequently, which may affect the long-term applicability of some findings. Despite these constraints, the research still offers relevant and practical insights, but future studies with broader datasets and updated platform analyses would help to further validate and expand upon the results.

1 LITERATURE REVIEW

1.1 Deep-Tech Startups and Their Value

1.1.1 Definition of Deep-Tech Startups

Deep-tech refers to innovations that originate from fundamental scientific research conducted across disciplines such as physics, chemistry, biology, and computer science . "*Essentially, deep tech refers to technologies that emerge from cutting-edge knowledge*." (Figueiró Longo et al., 2024). These technologies emerge from laboratories where researchers push the boundaries of human knowledge and capability. Deep-tech can also be referred to a process of applying cutting-edge scientific discoveries in developing solutions that give rise to entirely new, previously unimaginable technologies. This science-based innovation approach has two main advantages*: "* <…> *first, it reduces the search space by focusing on technologies that are most likely to work, limiting the need for trials and errors. Second, it fosters the conception of technologies that has never been explored before, allowing for a more far-reaching search process compared to the local search for lowtech innovations*." – (de Véricourt, 2024). In 2015, Swati Chaturvedi was the first who introduced the phrase "deep-tech" when she launched Propel(x), a pioneering investment platform that connected angel investors with scientifically driven startup companies. (Basilio et al., 2022). Deep-tech differs substantially from conventional technology approaches. Traditional tech companies typically focus on business model innovation, user-friendly applications, or incremental improvements to existing products (Ye et al., 2025) . Deep-tech, however, addresses complex, fundamental challenges that have the potential to transform entire industries and societal structures. Consider prominent examples: GPS navigation systems, mRNA vaccines, lithium-ion batteries, and Wi-Fi connectivity all began as deep-tech innovations.(Chui et al., 2022; Romasanta et al., 2022; Ye et al., 2025). When scientists first developed these technologies, they appeared revolutionary and almost impossible to implement. Today, these same technologies have become integral parts of daily life, so commonplace that their complexity goes unnoticed. This progression illustrates the deep-tech industry's evolutionary nature. Breakthrough innovations that seem cutting-edge today often transition into mainstream solutions as they mature and achieve widespread adoption. The cycle continues as new scientific discoveries create the next generation of transformative technologies.(Wareham et al., 2024; Ye et al., 2025).

Deep-tech startups are a category of young companies that concentrate on leveraging advanced technological or engineering breakthroughs, or turning major scientific discoveries into practical solutions, with the aim of driving business transformation and tackling large-scale societal challenges (Romasanta et al., 2022; Wareham et al., 2024). "<…> *deep-tech entrepreneurship represents a Promethean feat. Just as Prometheus descended from Olympus with fire to improve the lives of humankind, so too do these startups endeavor to bring scientific breakthroughs out of the confines of research labs and into the realm of practical application*" (de Véricourt, 2024). In line

with Francis de Véricourt, the founding Academic Director of the Institute for Deep Tech Innovation at ESMT, view, deep-tech ventures act as bridges between scientific discovery and real-world impact. Meanwhile according to study report on *Bolstering DeepTech Entrepreneurship for Sustainable Development in the ASEAN+3 Count*, they provide a precise formulation and description of start-up: "*Startups which are new firms (less than 10 years old), with a key business offering that (a) is developed based on deep technologies and their convergence; (b) has novel (or 6 disruptive) features in its business and/or technology approach toward impactful problem-solving; (c) has the potential for high-growth or scalability (scale-up); and (d) requires time and investment for business and technology development*."(Ministry of SMEs and Startups & Republic of Korea, 2025). This definition underscores the emphasis on innovation, scalability, and long-term investments as key aspects for fostering deep-tech entrepreneurship.

1.1.2 Unique Value Proposition of Deep-Tech

Deep-tech innovations are based on breakthrough scientific and technological discoveries that aim to address major societal and environmental challenges, that's why successful deep-tech startups can fundamentally transform industries and create entirely new markets (Schuh et al., 2022). Deep-tech startups are different from regular or tech startups in several ways (de Véricourt, 2024; Romasanta et al., 2022). Deep technology startups share the common characteristics of startups but have an especially strong focus on advanced technology (Schuh et al., 2022). Deep-tech startups usually spend money for a longer time before making returns, but progress in AI and the availability of more skilled people could help them become more like regular startups (dealroom.co, 2021). They usually rely on advanced technological innovations that need a lot of resources, such as skilled people, funding, and special equipment or facilities (**Error! Reference source not found.**).

On the other hand, many other startups use well-established technologies and focus first on creating their business models before adding technology. These startups also tend to avoid technologies that require large investments or lengthy testings. Moreover, deep-tech startups mix big, ambitious ideas with deep scientific research and practical business goals. Consequently, they face multiple challenges at the same time, including two main risks: high technological risk because the innovations are novel and untested, and high market risk because markets may not be ready to adopt them (dealroom.co, 2021; Ministry of SMEs and Startups & Republic of Korea, 2025; Romasanta et al., 2022; Schuh et al., 2022). The main differences are described in the figure below:

Figure 1 Deep-Tech vs Traditional Startups Comparison.

Source: (Ministry of SMEs and Startups & Republic of Korea, 2025)

While deep-tech startups share the core features earlier, it is not enough to only compare them with business-driven ventures. It is equally important to point out how they stand apart from more conventional general tech-based startups, since this distinction shows the specific nature of deep-tech innovation (Gourévitch et al., 2021; Schuh et al., 2023). "*Unlike general startups, deep tech startups are based on successful deep tech innovations which have the power to fundamentally change existing industries and to create new markets.*" (Ministry of SMEs and Startups & Republic of Korea, 2025).

Figure 2 Deep-tech startups vs general tech startups.

Aspect	Deep Tech	General Tech
Core Focus	Based on science and engineering.	Focused on software and services.
Innovation Type	Creates revolutionary technologies.	Makes incremental improvements.
Development Cycle	Long, research-heavy process.	Short, quick to market.
Talent Requirements	Needs specialised technical skills.	Requires general IT skills.
Market Impact	Disrupts industries, creates markets.	Improves existing markets.
Commercialisation	Slow due to complexity and regulations.	Fast with fewer barriers.
Intellectual Property	Strong and defensible IP.	Easier to replicate.

Source: https://www.exp.science/education/deep-tech-technology-revolution-driving-real-world-impact

Error! Reference source not found. compares deep-tech and general tech startups highlighting key differences in core focus, innovation type, development cycles, talent requirements,

market impact, commercialization speed, and intellectual property, demonstrating why deep-tech start-ups face more complex and longer paths to market. Deep-tech face both high technological risks: untested innovations and high market risk as markets for their solution may not yet exist at all. Unlike general tech startups, they often rely on multiple converging technologies and strong industry-level partnerships. And these start-ups typically move from development to commercialization as usual (Gourévitch et al., 2021; Ministry of SMEs and Startups & Republic of Korea, 2025; Romasanta et al., 2022; Schuh et al., 2023).

1.1.3 Impact of Deep-Tech Innovation

Deep-tech innovations, which are built on fundamental scientific discoveries and engineering breakthroughs have a profound and transformative impact across a wide range of industries. Unlike incremental advancements, deep-tech often creates entirely new capabilities and business models, challenging existing norms and redefining what is possible (Bhardway, 2025).

Deep-tech innovations provides solutions to problems that were previously considered impossible to solve or very complex to solve with traditional technology. It is best suited "*to solve intractable problems by providing unique and transformative solutions*" (Ye et al., 2025). IFC's investment note "Deep Tech Solutions for Emerging Markets" highlights and pay attention to how deep-tech startups focus on solving the world's biggest challenges, including expanding internet access, addressing climate change, and reducing greenhouse gases through advanced technology. As an example of this kind of solution, the biotech company "Apeel Sciences" has developed a technology that allows various types of fruit to last twice as long as usual. This technology is developed from natural sources and helps cut down on food waste across the supply chain, while also supporting more sustainable production and consumption practices (Apeel Sciences, 2025; Nedayvoda et al., 2020). Another example is superabsorbent hydrogels (SAHs) (Chang et al., 2010), which are made from cellulose and other renewable materials can tackle water shortages in dry regions. They work by drawing moisture from humid air and storing vast amounts of water, up to a thousand times their dry weight – making them a viable option for areas with limited resources (Matthews et al., 2024; Ye et al., 2025). This supports the view that: "*Deep tech has the potential to accelerate progress by offering solutions where traditional approaches often fall short*"(Ye et al., 2025). Building on this – innovations in fields such as genomics, AI-driven diagnostics and personalized medicine transform healthcare through more accurate disease detection, targeted treatments, faster drug discovery (Bhardway, 2025).

Deep-tech does not just improve existing processes it also enables entirely new ways of doing business (creates new business models) and creates new capabilities. *"<…> like other general purpose technologies, deep tech exhibits strong innovation complementarities, often both requiring and stimulating the development of new tools, infrastructures, and business models to unlock its full potential"* (Cabanes, 2025). Deep-tech startups often require the development of entirely new

business models to capture value from their innovations. This analysis draws on the article “Falling in love with strategic foresight, not only with technology: European deep-tech startups’ roadmap to success” by Alexandru Capatina, Gianita Bleoju and David Kalisz (2024), where noted that developing a business model involves testing how well new products and services are accepted by the market and ensuring they align with the value expected by the target customers. They also highlights that this is important because many deep-tech ventures need to move from a product-focused approach to service-focused, yet there is still limited guidance on how to create new offerings and design effective business models to support this shift. In addition, their success depends on the ability to simplify and communicate complex innovations, because “*business model design for high-tech firms must support knowledge translation for complex solutions to less qualified external audiences*”. Finally, researchers highlight that deep-tech ventures are increasingly integrating sustainability principles into their strategies and value proposition design(Capatina et al., 2024; Tronvoll et al., 2020).

1.1.4 Deep-Tech Market

The deep technology sector is experiencing worldwide expansion with international investment activity growing dramatically cross-border funding participation has surged by a factor of six since 2012 (Nedayvoda et al., 2020). "*Deep Tech Market Analysis – Innovations & Forecast 2024-2034*" (2024) – provides market forecasts showing strong growth potential for deep-tech, with an estimated CAGR (explanation: compound annual growth rate measures an investment's annual growth rate over a period of time) of 18.7% through 2034. This report significantly highlights emerging market opportunities in autonomous vehicles, blockchain, neurotechnology, and smart transportation systems fueled by deep-tech innovations. The global deep-tech market size now is anticipated to be worth around USD 3,857.1 millions by 2034 (Mordor Intelligence, 2024). Deep-tech now makes up about 25% of all European venture capital, with around €10 billion invested annually.(dealroom.co, 2021). As Ye et al. (2025) emphasize, “*A well-functioning deep tech investment ecosystem requires a diverse mix of funding sources <…> While public sector funding plays a crucial role in the early stages, ensuring a continuous capital flow through a combination of private investment, strategic partnerships, and alternative financing mechanisms is essential for long-term growth*.” Early-stage actors also play a critical role in this process, as “*angel investors and the diaspora are catalyzing the change*.” (Nedayvoda et al., 2020). Together, these trends demonstrate that deep-tech is not only reshaping global markets but also redefining investment ecosystems, requiring long-term strategies, diverse funding sources, and collaborative support to reach its full potential.

1.2 Deep-Tech in Beauty and Health Sectors

The beauty and health industry is experiencing rapid growth and constant innovation, with deep-tech innovations playing a central role in improving services, and solving health and beauty challenges. Skincare and cosmetics are fields that greatly benefit from technological progress particularly through the integration of cutting-edge scientific disciplines. In this context, nanomedicine, material science, artificial intelligence, synthetic biology, machine learning genetics and cellular therapies, additive manufacturing, and human-computer interaction can be considered prime examples of deep-tech that are revolutionizing how beauty and health products are developed, manufactured and delivered to consumers (Figueiró Longo et al., 2024). These advanced technologies enable the creation of more effective, personalized, and scientifically-backed solutions that address complex skin conditions, optimize product formulations at the molecular level, and provide unprecedented insights into individual beauty and health needs (Precedence Research, 2025). Researchers and innovators face many tough and varied challenges during their complex journey from foundational basic science to successful market innovation. This stage is one of the hardest parts of the innovation process, then promising scientific discoveries must be transformed into viable commercial products and/or services. Studies have already identified a wide range of obstacles common to deep-tech companies, which include not only technical difficulties but also the need for society to understand and accept these new technologies (Basilio et al., 2022; Figueiró Longo et al., 2024; Siqueira Andrade et al., 2024). As Siqueira Andrade et al. (2024) emphasize, the pharmaceutical and cosmetic industries have increasingly turned to technology to boost research and product development. To successfully apply cutting-edge innovations, a deep understanding of biology is essential (Leong et al., 2024).

The intersection of deep-tech and the beauty and health sectors presents transformative opportunities for creating more effective, personalized and science-driven solutions for people. However, realizing this potential requires overcoming significant technical, commercial, and societal challenges to successfully transform advanced researches into market-ready innovations.

1.2.1 Deep-Tech Startups in Beauty & Health

Deep-tech startups in the health sector (also could be called as Health-tech) have become significant players in the healthcare industry, transforming how medical services are provided, tracked, and accessed. Driven by advanced technological innovations and growing consumer expectations for tailored and streamlined healthcare solutions, these companies have established their presence within a specialized market segment (Chakraborty, Ilavarasan, et al., 2023). For example, deep-tech startups from health sector include companies developing messenger RNA vaccines for disease prevention, creating patients-on-chip technology for drug testing, using artificial intelligence to discover new medicines, building brain-computer interfaces to help paralyzed patients, advancing stem cell and gene therapies for genetic disorders, designing robotic surgery

systems for precise operations, working on regenerative medicine to repair damaged tissues, and manufacturing 3D-printed implants and organs to replace damaged body parts.(Peña & Jenik, 2023). And beauty-tech startups include AI-powered personalized cosmetics companies, virtual try-on platforms, smart skincare devices, biotechnology ingredient developers, automated beauty application systems, and digital skin analysis tools.(researchandmarkets.com, 2025). While these ventures typically operate on a smaller scale and focus on specific market niches, they possess substantial growth potential. Their agility gives them competitive advantages, though this comes with considerable risk: most face high failure rates, with only a select few achieving unicorn status. These organizations make meaningful contributions by implementing advanced medical technologies and targeting underserved populations through cost reduction strategies and enhanced service efficiency. Although various terms exist in the field including e-health and digital health enterprises the deep-tech health startup designation has gained widespread acceptance as a comprehensive category within the commercial startups and technology entrepreneurship sectors (Chakraborty et al., 2021; Chakraborty, Ilavarasan, et al., 2023). This aligns with the rapid expansion of the global health-tech market, which was valued at USD 106 billion in 2019 and is projected to reach USD 639.4 billion by 2026, reflecting growing demand for technology-driven health and beauty solutions (Ugalmugle & Swain, 2020).

Why Most Health-Tech Startups Fail

However, while the market outlook highlights huge potential, the reality for new ventures is far more challenging: "*Despite the opportunity, 98 out of 100 health-tech startups don't survive in the long run and cause financial and economic losses*" (Chakraborty, Ilavarasan, et al., 2023; Singhal et al., 2022). As it has shown, most of new companies fail, so only a few succeed in the long term. Statistics usually highlights that while about 90% of startups survive their first year, nearly 70% fail within five years, with the core reasons being lack of product-market fit, marketing issues, team challenges, and financial constraints (Attard, 2023). These failures compounded by regulatory complexities, extended sales cycles, and the difficulty of gaining credibility among multiple healthcare stakeholders, where decision-making processes can extend beyond two years (Attard, 2023). Furthermore, deficiencies in understanding market needs, insufficient clinical integration, and struggles with technological implementation hinder startups' ability to scale (Szathmári et al., 2024). As a result, many health-tech startups struggle not only to launch, but to sustain themselves, underscoring the need for strategic focus on market alignment, regulatory navigation, and stakeholder engagement to improve survival odds (Chakraborty, Edirippulige, et al., 2023).

Startups That Endured Through Innovation

Those start-ups that manage to endure often do so by introducing groundbreaking innovations that address unmet medical or wellness needs – „*due to the start-ups having a high*

failure rate, start-ups always need innovation to survive" (Diets et al., 2021). To illustrate this, several emerging start-ups provide valuable examples of how innovation is being applied within the health and beauty sectors. The following section provides an overview of several successful deep-tech startups in the beauty and health sectors.

Pulsetto, a Lithuanian health-tech startup, has developed a wearable non-invasive cervical *vagus* nerve stimulator designed to influence autonomic nervous system activity. The device, commercially available since 2022, delivers mild electrical impulses through the skin of the neck to stimulate both left and right branches of the cervical *vagus* nerve. Marketed as a tool to reduce stress, anxiety, and burnout while improving sleep and overall mental well-being, Pulsetto represents a novel approach within digital health and wellness technologies. Pulsetto exemplifies how emerging deep-tech startups are translating neuromodulation research into consumer-oriented devices, bridging the gap between advanced biomedical innovation and accessible health solutions (Machetanz et al., 2021a; pulsetto.lt, 2025; Van Den Bogaert, 2024).

Another example of an innovative health-tech startup is Kriya Therapeutics, a company that is redefining the possibilities of gene therapy. Founded in 2019, it is building a fully integrated platform that unites computational design, translational science, and large-scale in-house manufacturing – an uncommon approach among early-stage biotech firms. By focusing on one-time genetic treatments for ophthalmology, metabolic diseases, and neurology, Kriya is tackling conditions that currently require lifelong management. Its strategy of developing durable, precise, and patient-friendly therapies has attracted more than USD 600 million in venture funding, positioning the company as a leader in deep-tech health innovation. Kriya illustrates how a startup can combine cutting-edge science with entrepreneurial drive to push the boundaries of what modern medicine can achieve.(Eclov et al., 2025; kriyatherapeutics.com, 2025).

Function of Beauty is a beauty-tech startup that specializes in fully personalized hair, skin, and body care solutions. Founded in 2015, by two graduates and a chemist, the company set out to challenge industry norms by replacing generic product categories with individualized formulas created through a simple online quiz. Using data science and proprietary algorithms, Function of Beauty translates each customer beauty goals into unique formulations that are produced in its in-house manufacturing facility. By combining advanced technology with on-demand production, the company has provided a new alternative for the traditional beauty market into a truly customizable, consumer-driven experience (crunchbase.com, 2025; functionofbeauty.com, 2025).

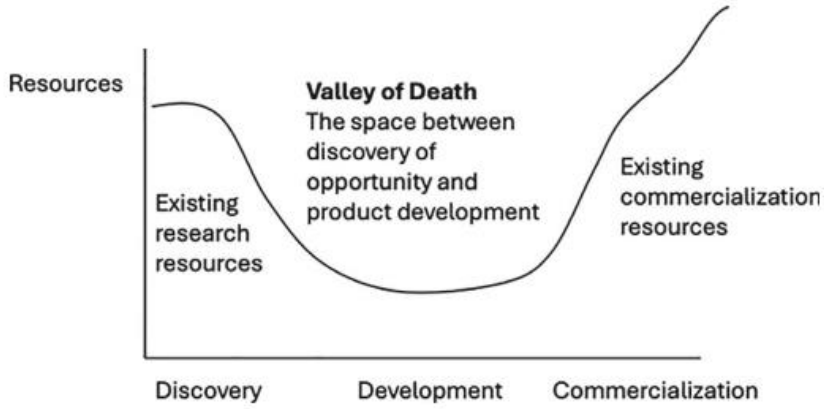
Aethera Biotech is also an example of a beauty-tech startup which is focused on creating innovative, plant-derived active ingredients for the cosmetics and personal care sector. Established in 2016 within the Cereal Docks Group, the company emerged with the goal of reshaping the beauty industry by replacing conventional synthetic compounds with sustainable, biotech-derived alternatives. Using its proprietary CROP® platform, Aethera Biotech harnesses in vitro plant cell cultures to produce standardized, high-quality bioactive ingredients that are both scientifically

validated and environmentally responsible. By combining advanced biotechnology with applications in skincare and wellness, the company provides a novel alternative to traditional beauty solutions, contributing to a new era of natural, traceable, and innovation-driven cosmetics (aetherabiotech.it, 2025; LUCIANI, 2025; Pressi et al., 2022).

1.3 Commercialization Challenges for Deep-Tech Beauty & Health Startups

From AI-driven skincare to biotechnology-based health solutions, these deep-tech startups aim to disrupt traditional industries with new and advanced technologies. This leads to the fact that bringing deep-tech innovations to market is a very challenging process: deep-tech startups often require long R&D cycles, an understanding of the target market, heavy capital investment, bridging the gap between science and business, and navigation of complex regulations.(G-Institute of technology, 2025). According given the challenges, researchers emphasize that commercialization is nonetheless essential for unlocking the value of such innovations – "*commercializing means turning research discoveries into useful products or services that solve real problems*."(Elomaa, 2025). As (Nedayvoda et al., 2020), note, "*Yet commercialization is critical to realizing the benefits of deep tech solutions, and deep tech firms often struggle to successfully commercialize their breakthroughs*." Similarly, (Kruachottikul et al., 2023) emphasize that "*Nonetheless, the journey of transforming a mere invention or idea into a market-ready innovation is laden with uncertainties and risks. As a result, many inventions fail to survive the commercialization stage*." Together, these insights show their real impact depends on overcoming the fragile and uncertain path of commercialization, but one that deep-tech start-ups must complete if they want to grow and succeed. This critical juncture is often described in the literature as the "Valley of Death," (Figure 3) the space between research and product development, or between the discovery of an opportunity (invention) and the process of turning it into a viable innovation. Navigating this valley requires not only technical expertise but also strategic resources and support systems to prevent promising ideas from collapsing before they reach the market.(Kruachottikul et al., 2023).

Figure 3 Illustration of the Valley of Death



Source: (Kruachottikul et al., 2023)

Deep-tech's characteristics make these startups more challenging to attract investment and achieve commercialization than other types of ventures. Consequently, failure rates are particularly high, limiting opportunities for societal and commercial impact. According to Five Principles for Overcoming Obstacles in Deep-Tech Startup Journeys by Johan Kask and Gabriel Olav Linton (Kask & Linton, 2023): "<…> *often fail due lack of tailored support, too few valuable connections and poor funding. Overall, today's innovation systems are not very well designed for deep-tech startups*."

Deep-tech startups face with various difficulties or challenges or even barriers at multiple levels. A 2023 study of health-tech ventures in the UK identified "*macro-, meso- and micro-level barriers these technology-based enterprises perceive in the healthcare industry*", barriers was ranged from systemic issues to human factors. The authors found "*systemic barriers, such as lack of funding and procedural issues; sector-related barriers, such as market-related impediments; human barriers, including psychological barriers and resistance to new technology; and implementation barriers, such as operational and personnel issues.*" (Singh et al., 2023). These challenges tend to be more acute for deep-tech start-ups due to their reliance on novel science, longer development timelines, and the critical importance of credibility in health and beauty markets (Kask & Linton, 2023; Singh et al., 2023). Below, analyzed four key categories of commercialization challenges: funding, product development, regulatory, and go-to-market.

1.3.1 Long Development Cycles, High R&D Costs

Deep-tech products in beauty and health sectors demand extensive R&D (Research and Development) and often face long development timelines: "*While the timeframe for each stage of the tech commercialization process differs by sector, on average it used to take up to several decades (five to 10 years for spacetech, 10 to 15 years for energy, and seven to 10 years for biopharma) to bring a deep tech innovation to market*".(Nedayvoda et al., 2020) . App-based startups that can iterate quickly, otherwise a deep-tech start-ups need much more time to achieve scientific breakthroughs, laboratory tests or engineering milestones before a viable product exists. There are

more expensive development cycles (e.g. prolonged R&D and prototyping). This makes investors hesitant. Kruachottikul et al. (2023) cites a "s*carcity of private capital, especially in the face of long and costly commercialization processes*," which "*can pose major barriers to startups seeking funding*". Another challenge is that ongoing R&D work is hard for outsiders to assess or value until it yields a finished product. According to the literature, "*the evaluation of research and development activities can be challenging and frequently holds little practical value until a product is finished*" (Kruachottikul et al., 2023). In other words, during the development phase, a deep-tech startup may have little tangible to show, making it difficult to attract funding or support. This creates an obstacle for companies engaged in protracted and expensive development efforts, since investors often want proof of a viable product before committing funds. Also, there is another side of the coin where investors have a lack of knowledge about such technologies – "*investors often have limited understanding of the technical and economic feasibility of many deep tech innovations".(Nedayvoda et al., 2020).*

In the beauty sector, for instance, a start-up developing an AI-powered diagnostic skincare device must not only perfect the hardware and algorithms but also validate them. Validation with dermatological data is a process that can take years and „*the stringent regulatory environment in healthcare can increase development costs and delay time to market, making it less attractive to investors".*(Price, 2024). Similarly, health tech devices or therapeutics must undergo rigorous testing (often clinical trials) to ensure safety and efficacy. These extended development requirements increase costs and delay revenue, compounding the funding challenges noted above. (Haykal & Flament, 2025; Price, 2024; Young, 2025).

1.3.2 Funding and Investment Challenges

Beyond internal issues, deep-tech product development is hindered by external challenges in the innovation ecosystem, particularly regarding funding and support structures. Developing cutting-edge technology in beauty or health often demands substantial capital (for laboratory research, clinical trials, specialized equipment, etc.) long before any revenue is realized.(Haykal & Flament, 2025; Price, 2024) „*The two prominent elements of financial risk are lack of resources, and fundraising challenges*" (Myers & Albats, 2024). Getting venture capital (VC) is especially important for deep-tech startups, since they usually need about 48% more money and take 35% longer to develop than traditional start-up. Without enough private investment, many of these companies find it difficult to cross the Valley of Death once public funding runs out.(Elomaa, 2025). Unlike other startups that can grow quickly with less money, deep-tech start-ups need large upfront funding for R&D, prototyping, testing, and regulatory approvals before they can enter the market. Because development takes much longer, deep-tech startups often need years to commercialize and rely on investors who are patient and willing to commit for the long term.(Ye et al., 2025). So as a

consequence is that investors can be hesitant to back deep-tech ventures due to the high technical risk and longer time to market compared to digital or consumer startups.(Elomaa, 2025).

A 2024 review of MedTech (medical technology) startups notes that these companies face "*regulatory hurdles and high capital requirements*", emphasizing that significant funding is needed to bring medical innovations to market. Collaboration with public research institutions and government funding is often crucial – the literature highlights the importance of university–industry–government collaboration and even non-traditional financing (like crowdfunding) to fill funding gaps. (Kalinowska-Beszczyńska & Prędkiewicz, 2024).

Funding is a major challenge for deep-tech startups everywhere, although some regions have built stronger support systems. A Boston Consulting Group (BCG) report (2021) highlights that traditional venture capital models are not well-suited for deep-tech: 81% of founders said investors lack the scientific expertise to judge their opportunities, and the common VC focus on quick returns "*doesn't work for deep tech, where significant resources are needed in the early years*." Because of this, specialized deep-tech funds remain small, and many investors are cautious about the long timelines(Gourévitch et al., 2021). This problem is especially relevant for health-tech and beauty-tech startups. For example, a biotech cosmetics company developing a new ingredient may spend years on research and regulatory testing before seeing profits, which can test the patience of traditional investors. In emerging markets, funding gap is often even larger, though government programs are starting to provide more support(Gourévitch et al., 2021; Price, 2024) . Overall, the lack of patient capital and knowledgeable investors remains one of the barriers to commercialization.

1.3.3 Team Related Barriers

Team composition and human capital represent a critical challenge for deep-tech startups during the commercialization process*. "Deep tech ventures demand a highly skilled workforce with advanced technical expertise" (Ye et al., 2025)*. Higher education, sector-specific work experience, and especially prior startup experience with greater success in bringing products to market. Deep-tech founders often lack all the necessary knowledge themselves, and it's "*challenging for individuals to have comprehensive knowledge and experiences required*". This means important R&D and product development expertise may be missing on the team, slowing innovation (Kruachottikul et al., 2023). Numerous scientists find themselves unprepared for the entrepreneurial world when attempting to bridge the gap between laboratory and marketplace. Usually, their expertise lies in discoveries and technical innovation, but they frequently stumble when it comes to building sustainable business models, understanding customer needs. Academic research groups typically focus on advancing knowledge and publishing findings rather than developing commercially viable products. This academic orientation creates challenges when pivoting to market-focused thinking. Particularly when it is time to demonstrate profit potential within tight timeframes. Investment

professionals recognize this disconnect and gravitate toward ventures led by teams that can quickly execute go-to-market strategies and scale operations effectively.(Elomaa, 2025; Price, 2024).

1.3.4 Policy and Regulation (regulations, certifications, consumer trust)

Regulatory complexity is a defining challenge in health and to a lesser extent in beauty. Health-tech startups, especially those dealing with medical devices, diagnostics, or therapeutics, operate in "*a highly regulated health care environment*" that can stifle rapid growth.(Pfitzer et al., 2024). Getting approval from regulators such as the U.S. FDA or European authorities can be a long and difficult process. For digital health startups, proving that software qualifies as a medical device or ensuring patient data privacy is just as important as the technology itself. A review of growing digital health companies showed that following regulatory and policy rules is one of the most common factors for success. However, compliance takes a lot of paperwork, clinical proof, and time, which can delay entry into the market and make investors hesitant. Many digital health startups "*struggle to scale*" because of these regulatory hurdles, even when their technology works well.(Pfitzer et al., 2024).

Beauty-tech start-ups also face regulatory hurdles although typically less strict than medical start-ups unless their product makes health claims. Cosmetics and personal care products must meet safety standards and ingredient regulations that vary by country. For innovative beauty devices (e.g. at-home skin laser devices), there may be ambiguity in regulation – some devices might be classed as medical devices if they claim therapeutic benefits, triggering higher compliance requirements.(Town et al., 2012). When expanding globally, startups must contend with different regulatory regimes. Industry analyses point out that "*regulatory challenges vary from region to region, posing challenges to global expansion on the compliance front*".(Fact.MR, 2025). Data privacy laws (such as GDPR) also impact beauty tech that uses personal data (e.g., facial recognition in smart mirrors) (The London Brow Company, 2023). In short, regulatory and compliance demands spanning product safety, efficacy validation, and data protection form a significant barrier that deep-tech start-ups in health and beauty must plan for early in the commercialization process. Start-ups that proactively engage with regulators and prioritize compliance can turn this challenge into a competitive advantage, signaling quality and safety to consumers.(Buziak, 2024; Fact.MR, 2025; Fourcher et al., 2020).

The necessity of securing intellectual property (patents) is another challenge, while deep-tech start-ups typically generate distinctive IP, obtaining and defending patents globally can be expensive and time-consuming. The 2024 systematic review on emerging deep-tech entrepreneurship noted that deep-tech ventures almost always involve complex, physical innovations and often emerge from research labs, implying that technology translation is a non-trivial step. (Gourévitch et al., 2021).

1.3.5 Market Entry Barriers

Even after surmounting development and regulatory challenges, deep-tech startups in beauty and health sector face with go-to-market challenges in gaining adoption and scale – "*deep tech startups take approximately 35% longer to reach market viability" (Elomaa, 2025)* in comparison with traditional startups. A significant challenge is to convince customers and/or investors of the product viability. Many deep-tech startups struggle to identify and engage the right markets due to the specialized nature of their products. These products or technologies often do not fit established market categories, that is why understanding specific customer needs and geographic dynamics is crucial for successful entry to the market.(Gachet, 2024). Another major challenge is breaking into markets dominated by established big players. The beauty industry is a "*mosaic of established brands*" with entrenched customer loyalty, making it hard for newcomers to carve out market share. (FasterCapital, 2025). In healthcare, hospitals usually prefer to buy from well-known suppliers. Trying to participate in the market leads to higher costs and discourages. As a result, many new deeptech startups struggle to win hospital contracts or even get listed in procurement systems. The European Commission has noted that small and medium-sized businesses face significant barriers when entering public healthcare markets.(Siciliani et al., 2021). Industry data also show that major companies (GE Healthcare Technologies and Medtronic) hold a large share of the market (Chakraborty et al., 2021; Siciliani et al., 2021). These explain why even highly innovative startups find it very difficult to succeed. Growing young beauty and health deep-tech business takes more than just partnerships, they need close and technical relationships with the right partners to build credibility and open doors to the market.(De La Tour et al., 2020). A global analysis by Boston Consulting Group found that 42% of deep-tech startups identified the lack of a distribution network as a key roadblock, far higher than in other types of startups.

Their go-to-market strategies must be carefully planned with longer lead times to educate future customers and establish trust, unlike traditional startups. (Gachet, 2024; Montanaro, 2025). As noted in one industry report, "*winning the hearts and loyalty of consumers is a steep climb. New entrants must build trust from the ground up, unlike legacy brands with years of rapport*". (FasterCapital, 2025). As an example would be startup like Function of Beauty (mentioned before), which leverage social proof and user-generated content to encourage trust, transforming their customer base into brand ambassadors. Deep-tech startups must often invest in education and marketing to convince customers of their product's value – for example, explaining the science behind a skincare AI app or demonstrating a digital therapeutic's clinical efficacy to providers.(de la Tour & Portincaso, 2021; de Véricourt & Dahlander, 2024). "*This can be done by creating high quality content assets and then distributing them through the various marketing channels. Typical online distribution channels are email, website, social media and events. It is important to note that*

distribution channels which work for one deep tech startup may not work for the other. The right channels are the ones where your target audience is present."(Agarwal, 2024b).

In the beauty and personal care market, consumers tend to be cautious about new formulations and devices. Trust is a significant factor – people are putting these products on their bodies, so safety and efficacy concerns are important. Recent market research by Mintel found that "*nearly one in four beauty and personal care consumers find it difficult to trust new ingredients*" – Carson Kitzmiller, Principal Analyst, Beauty & Personal Care, (Stern, 2025a). Shoppers worry about unknown chemicals or unproven claims, reflecting a general skepticism toward novel formulations. This means a deep-tech beauty startup (for example, one introducing a cutting-edge skincare ingredient or an at-home beauty device) might face hesitation from customers until it proves itself. Thus, breaking into the market requires overcoming an inherent trust gap, consumers need reassurance that the new product is both safe and effective (Alnuqaydan, 2024; Korkuzas, 2022). So, as Supriya Agarwal (2024) highlighted in her work education, communication and trust building is the way to overcome this barrier – "*promote relevant content in an engaging manner <…> articulate the problem you are solving and break down the complex terms into understandable and relatable benefits for the target audience*".

Additionally, market entry can be impeded by human and cultural factors. Each region's consumers have distinct expectations and norms, meaning approaches must be tailored to target audience local preferences.(Ferraro & Briody, 2023; Rachwal-Mueller et al., 2024). For example, deep-tech beauty devices or AI-driven services that excite gadget-loving buyers in tech-embracing markets like South Korea or China might face resistance in places where shoppers prefer hands-on, human interactions. In those cultures, customers may be skeptical of "smart" products until they see proven results, recommendations or demonstrations.(Butt et al., 2022; Mustafa Ayobami Raji et al., 2024). Adapting the user experience and marketing messages to align with local cultural values is therefore important to overcome these barriers and achieve successful adoption.

1.4 Social Commerce is Overcoming Market Barriers

Given the challenges and barriers above, deep-tech startups in beauty and health sectors are exploring innovative strategies to accelerate commercialization. According to the scientific study "Marketing for Deep Tech Startups" by S.Agarwal, one promising approach is leveraging social commerce – selling and engaging with consumers through social media platforms and online communities. The authors note that startups should "d*istribute content through email and social media. <…> [and] plan a social media calendar to promote relevant content in an engaging manner*" when their target audience is active online. (Agarwal, 2024b). Social commerce has surged globally in recent years, particularly in consumer-facing industries like beauty.(X. Tang, 2024). It blends the reach of e-commerce with the influence of social networks and influencers enabling brands/start-ups to build awareness, trust, and sales in more interactive ways than traditional stores (Joyce L.,

2024; Stern, 2025b).Social commerce offers a relatively low-barrier path to market entry and growth for resource-constrained startups.(Agarwal, 2024b).

1.4.1 Definition of Social Commerce

Over the past few decades, e-commerce has experienced significant transformations in its operational processes, service delivery models, and approaches to managing customer relationships. The integration of such innovations has reshaped the foundations of online business, particularly through the incorporation of social media elements into e-commerce platforms, giving rise to what is now known as **social commerce** (Attar et al., 2022).

As platforms such as Facebook, Instagram, and Twitter gained popularity, they transformed the way people shop online. "<…> *social media platforms have made a revolution by creating features or modules that can help existing business transactions, such as Instagram for Business, Facebook Business Page, and TikTok Shop, which facilitate the purchase decision phase. These business opportunities emerged from a new e-commerce model: social commerce.*"(Putri et al., 2023). Rather than only browsing products on a retailer's website, consumers began discovering items through friends' posts, influencer recommendations, and interactive features that allowed them to purchase directly within social media environments .(D. Herzallah et al., 2025; Riaz et al., 2021). Molinillo, Aguilar-Illescas, Anaya-Sánchez, and Liébana-Cabanillas (2021) emphasize that the design of social commerce platforms plays a crucial role in shaping perceived value and fostering loyalty behaviors, with factors such as gender, age, and usage frequency influencing these dynamics. In this context,"<...> *businesses use social media to sell, create communities, interact and engage with their customers, and to develop loyalty behaviors, through tools such as online chats, review systems, virtual groups and video sharing, among others.*" (Molinillo et al., 2021).

Social commerce combines the interactive and community-oriented nature of social media with the technological e-commerce capabilities, creating platforms where consumers can connect, share information, and influence each other's purchasing decisions (Attar et al., 2022). Building on this perspective, Isabel et al. (2022) highlight the specific features that distinguish social commerce from traditional online shopping, noting that "*The main functionalities that differentiate s-commerce platforms are group purchases, live broadcasts, platform gamification, communities, blogs, among many others that generate a social environment. This provides a space where the focus of consumers when shopping ceases to be for necessity and becomes an experience of entertainment and enjoyment itself, as it usually happens in the face-to-face shopping experience.*" (Isabel et al., 2022). By enabling conversations, reviews, and recommendations, these platforms foster a sense of community that not only facilitates decision-making but also enhances the overall shopping experience. Social interactions within social commerce play a crucial role in building consumer trust and reducing perceived risks, which in turn increases the likelihood of making a purchase(Govender et al., 2023). Trust plays a crucial role in online transactions, where the lack of face-to-face

interaction makes it a key factor in purchase decisions and customer loyalty. In this context, trust reflects a consumer's willingness to rely on sellers, other users, or the platform itself without direct control.(Wang et al., 2022).

1.4.2 Main social commerce work concepts

From a business perspective social media gives the chance to promote their brand, products and services (Al Rabea et al., 2023). This insight illustrates how, in today's fast-paced digital world, social media has become the primary technology for younger generations especially millennials and generation Z to engage with brands, driving companies to adapt their marketing strategies accordingly. As a result, brand visibility today depends heavily on social media advertising (Al Rabea et al., 2023; The Hung et al., 2025).

Building on this, companies are using social media more strategically through collaborations with trusted influencers "*who have a large following and are often celebrities or well-known personalities*"(Joyce L., 2024). These may be experts, enthusiasts of a particular topic related to the product, or just very popular figures with thousands of followers (Rachmad, 2022) .These influencers create content that breaks down complex ideas into something people can understand. Another type of influencers – micro-influencer which focus on niche audiences with strong engagement. Valued for their authenticity and relatable recommendations(Joyce L., 2024).

The whole point is to make new or confusing products feel closer. When person trusts and follows how influencer explains how something works, they are way more likely to believe it's worth trying. These influencers use videos, posts, live streams, and other interactive content to teach their audiences about news in a way that feels natural and engaging (Belanche et al., 2021; Sokolova & Kefi, 2020). Campaigns like the Nest Brush (the world's 1st silicone self-dispensing sonic toothbrush with UV-C tech) collaborate with Dental Digest. A prominent YouTube creator, Dental Digest, demonstrated product use while educating the audience about its technological features, resulting in extensive reach. (Castany, 2025).

Alongside the influencer-educator approach, another important concept in social commerce is the community-building concept. The community-building in social commerce focuses on creating connections and active participation among users. It is a model where customers are not only buyers but also members of a supportive community. Peer groups, discussion forums, and user-generated content such as reviews, likes, feedback, and personal stories play a key role. These contributions provide social proof, strengthen credibility, and give valuable feedback and insights. Platform algorithms often highlight community-generated content, giving stories greater visibility. This helps build trust, increase engagement, and speed up the adoption of new products. Ultimately, this model transforms customers into active brand advocates and co-creators (Algharabat & Rana, 2021; L. Liu, 2024; Tajvidi et al., 2020).

1.4.3 Growth and Reach

Social commerce is no longer a niche – it is becoming a dominant channel in beauty retail. Recent industry data indicates that social and online channels now account for over half of global beauty sales, with social commerce alone driving "*68% of beauty sales globally*"(Ludmir, 2025). While that figure may include varied definitions, it underscores a massive shift – brands can "*no longer afford not to be active*" on social selling platforms(Ludmir, 2025). The rise of influencer marketing, user-generated content, and seamless shopping features on apps like Instagram, TikTok, and WeChat means startups can reach larger audiences without the traditional infrastructure of brick-and-mortar distribution (Joyce L., 2024). According to a 2024 report cited by Reshift Media: "*Globally, social commerce is expected to reach $2.9 trillion by 2026. Social commerce sales will account for 6.6% of total ecommerce sales in 2024 and are expected to grow to 17% in 2025*." According to forecasts for an more longer period global social commerce market size is projected to reach USD 17.83 trillion by 2033 (Lee, 2025).

In China – a pioneer in social commerce – live-stream shopping and influencer-driven sales have achieved staggering conversion rates. For example, live commerce events in China attain conversion rates of ~30%, up to "*ten times higher than conversion in conventional e-commerce*"(Becdach et al., 2022). Beauty and fashion influencers can sell millions of dollars of product in minutes during livestreams(Becdach et al., 2022). All this illustrate the potential sales social commerce is capable to generate, which deep-tech beauty and health start-ups can harness to overcome the slow burn of traditional retail growth. A new start-up with a compelling story (for example a new AI-powered skincare daily device) can demonstrate it in a live video instantly reaching consumers who can purchase with one click.

1.4.4 Building Trust and Community

It is not just about sales social commerce is about engagement and trust-building, which directly tackles the consumer trust barrier noted earlier. By fostering online communities, start-up can turn early customers into brand advocates. The findings of a review on e-trust in social commerce (2023) : "*92% of consumers trust Word of Mouth (WOM) from people they know, 90% of consumers will read reviews before deciding whether to buy from a brand, and 72% will continue to make purchases after reading positive reviews*"(Hong et al., 2023). Social proof such as reviews, testimonials, influencer endorsements – is on full display in social commerce, which works psychologically and can reassure skeptical consumers about a new technology or innovations (Guo & Li, 2022; Park et al., 2023; Patwa et al., 2024).Researchers have observed that social commerce essentially "<…> *shifts the power from seller to buyer and provides multiple options to consumers*"(Mishra & Pandey, 2023), empowering users to influence others and shape brand narratives. For a deep-tech startup, this can be beneficial: rather than solely pushing advertising, the startup can facilitate dialogues, education, and peer recommendations around its product. „*An*

individual often practices social proof when looking through reviews and testimonials of the product by other consumers in order to solidify their trust in the brand and to make their final decisions".(Park et al., 2023). For instance, a biotech beauty company can collaborate with skincare influencers to explain product complexities in simple, authentic ways (for example a video of popular blogger or influencer using a product in their daily routine and sharing results). Reports notes that brands are doing exactly this – "*shifting from traditional ads to fun, engaging content that <…> highlight unique product features or explain complexities simply <…> rather than watching an ad for a new skin-care formula, your favorite celebrity can invite you behind the scenes into their daily skin-care routine, showing you how they use the branded product and why they love it* "(Becdach et al., 2022), and viewer can buy it right within the app. This kind of content helps demystify advanced products and build credibility through relatability(Korkuzas, 2022). In health tech, patient communities and health influencers (for wellness devices, fitness tech, etc.) play a similar role in educating and introducing new technologies.

1.4.5 Cost-Effective Marketing and Market Entry

Traditional go-to-market strategies often demand large budgets for advertising, retail partnerships or salesforces – resources deep-tech startups usually do not have (Hilong, 2023; Hong et al., 2023). Social commerce "*not only reduce the cost of entry, but also provide scalable solutions that can grow with the business*" (Krivokućа et al., 2024) together offer startups an affordable pathway to reach customers compared to traditional advertising and can significantly lower the cost of market entry by enabling organic growth (Sasikumar & Sersia, 2020; Subramanian et al., 2023). Viral marketing campaigns on social media can achieve wider exposure compared to the cost of traditional advertising. Online word-of-mouth and influencer sharing can spread product information quickly and broadly.(Han et al., 2025). For cash-strapped startups social networks thus provide a cost-effective marketing channel, making it possible to grow organically without large ad budgets. Moreover according to Hilong, 2023 : „*social media is the most economical approach to promote and advertise a business.*" Unlike traditional advertising limited by geography, Internet and social media marketing can reach potential customers anywhere in the world at any time.(Krivokućа et al., 2024). Usually used trend is to create a viral challenge or educational campaign on social media, effectively reaching customers.(Krishnan et al., 2022). Additionally, social platforms provide granular targeting, allowing niche deep-tech products to find their specific audience globally (Hilong, 2023; Joyce L., 2024), for example a connected diabetes management device can target diabetes community groups worldwide via TikTok or Instagram. The interactive nature of social commerce also provides rapid feedback which is valuable "*for customers to voice their opinions about new products*"(Han et al., 2025). There appears one more advantage – social media enables two-way conversations between businesses and their customers.(Aljuhmani et al., 2023; Krivokućа et al., 2024). Users might discuss what they like or dislike in real-time and startups team can iterate or

provide responsive customer support at the same time refining the product. It allows customers to provide real-time feedback and suggestions, making them an important part of the development process.(Han et al., 2025).

1.4.6 Effectiveness and Applicability

Consumers enjoy the seamless and interactive experience of shopping within social platforms, finding it more engaging and convenient (Li & Chang, 2024). A critical advantage of social commerce is providing a seamless shopping experience embedded(Wu et al., 2023). (Wu et al., 2023) analysis gives insights that social commerce is *"an increasingly popular offshoot of e-commerce propelled by <…> community and communication,"* noting that it *"offers new channels and formats to connect with consumers and gain a better understanding of their needs… consumers can be reached where they already want to be"*. For a deep-tech startup introducing a new beauty or health product/technology, this is ideal to meet the customer in a "*comfortable social environment*" (their social feed). In this familiar setting, consumers are more receptive – they're relaxed, entertained and open to discovery. For the young start-ups this translates into higher engagement and the ability to build relationships more naturally rather than asking them to find product on a shelf.(K. L. Tang & Huam, 2021). The network effect is powerful tool – a savvy social commerce strategy can trigger exponential growth if the product hits the right nerve (Cao et al., 2021). For example, the explosion of at-home beauty-tech devices in Asia has been attributed in part to influencer-driven social selling on platforms like Douyin (formally TikTok) and REDnote, which rapidly educated consumers and created trends for LED masks, facial devices, etc.(Warn, 2022). These social platforms have become "*primary channels for beauty influencers to share product suggestions and beauty advice, impacting how consumers make purchases*."(Gao, 2024).

It is important to note that social commerce is more immediately applicable to B2C (business-to-consumer) contexts (Kuivalainen, 2024; Schwob et al., 2023) – hence its strong impact in beauty sector. For health startups with B2B models or heavy regulations social commerce's direct sales might be less relevant. However, even these deep-tech startups can use social platforms for brand building, thought leadership, and community engagement (Rajagopal & Thileepan, 2024). Important to note, that in the consumer health and wellness deep-tech sector, social commerce is highly relevant – wearable health gadget startups (for example Pulsetto) and digital wellness apps thrive on app stores and social media promotion. Recent research on AI-enabled social commerce in healthcare found that integrating social platforms into health education "*improve[s] healthcare engagement and patient empowerment,*" delivering personalized health information and encouraging positive behavioral changes(Grover & Arora, 2024). In essence, social commerce leverages a power of community and influence – a potent tool for any new start-up trying to break into the market(Kim & Chan-Olmsted, 2022).

2 EMPIRICAL RESEARCH DESIGN AND METHODOLOGY

Based on the literature review conducted in the previous part this chapter details the research methodology.

2.1 Overall Research Design and Logic

This empirical research applies mixed methods empirical research design, combining case study analysis and quantitative survey research. The use of both those methods is purposeful and complementary and allowing the research to capture not only how deep-tech startups use social commerce in practice, but also how consumers perceive and respond to these kind of practices.

The main objective of this research is to examine how social commerce platforms can support the commercialization of health and beauty deep-tech startups. Specifically, it aims to evaluate the impact of social media platforms on consumer attitudes and behaviors, such as trust, engagement, and purchase intentions, toward innovative health and beauty products developed by deep-tech startups. This focus addresses the common market entry and commercialization barriers deep-tech startups face in reaching consumers, while exploring how social commerce could provide an effective strategic solution.

By focusing on consumers who use Instagram and/or TikTok for shopping or product discovery, the research seeks to determine whether and how an active social commerce presence helps deep-tech startups overcome traditional market barriers (such as: low consumer awareness or trust(Gachet, 2024)) and accelerates their path to wider market.

Key questions:

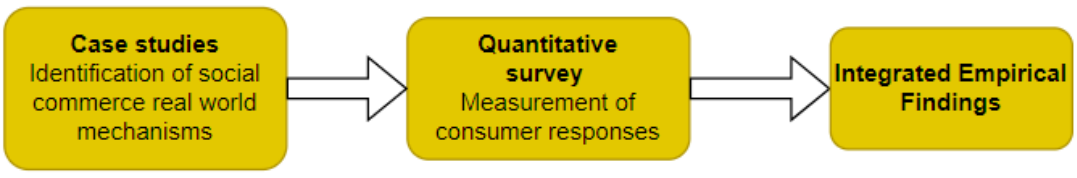
1. How can deep-tech startups leverage social media platforms to enhance product discovery and reach potential consumers?

2. How do consumers perceive and respond to deep-tech innovations when these are promoted through social commerce channels?

3. To what extent can social commerce serve as an effective market entry and growth strategy for deep-tech startups?

Case studies are used to explore real-world implementation strategies of social commerce by deep-tech startups, while quantitative survey is used to measure consumer responses to the same mechanisms identified in the case studies. A visual scheme illustrate the empirical research logic, showing the connection between case studies and survey.

Figure 4 Empirical research logic



2.2 Integration of Case Studies and Survey

The empirical research consists of two interconnected components:

1. Case study analysis, focusing on how deep-tech startups operationalize social commerce features in practice;
2. Quantitative consumer survey, examining how these features influence consumer engagement, trust, and purchase intention.

These methods are not treated as independent analyses. Instead, case studies inform the design of the survey by identifying key social commerce features (influencer use, educational content, platform-native tools and others), while the survey empirically tests consumer reactions to these features. This design enables triangulation and strengthens the validity of the findings.

2.3 Case Study Analysis

2.3.1 Case Study Selection Criteria

Seven case studies were selected based on explicit inclusion criteria ensuring relevance to the research objectives and analytical consistency. The selected companies meet the following criteria:

1. Deep-tech orientation – core value proposition is based on advanced technology or scientific innovation (biotechnology, AI, data-driven personalization and others);
2. Operation within the health and/or beauty sector;
3. Active use of social commerce platforms, such as Instagram or TikTok, for product promotion, consumer engagement;
4. Availability of publicly observable data, including social media activity, platform features;
5. Variation in commercialization maturity, allowing comparison across different growth stages.

In addition, one non–deep-tech startup was included to enhance comparative diversity.

2.3.2 Case Study Analysis Logic

Case studies were selected to gain insights into the understanding of real-life examples of deep-tech startups in the beauty and health sector. The objective is to obtain a comprehensive understanding of this kinds of startups, including their products, innovations and commercialization challenges. The goal of case studies is to compare how deep-tech startups in the beauty and health sector utilize (or not) social commerce tools and strategies to commercialize their innovations, examining their profiles, technologies, approaches, challenges, and outcomes.

The case studies examine each startup based on the following criteria:

1. Startup profile description (founding year, location, size, and main product focus);
2. Core technology or innovation type (description of the deep-tech aspect (for example: AI, biotech, nanomaterials, etc.);
3. Target market and customers (who the startup aims to reach and serve);
4. Commercialization strategy (how the startup brings its innovation to market);

5. Social commerce platforms used (which social networks are leveraged (Instagram, TikTok, etc.) and why);
6. Challenges in Commercialization (technological or market barriers the startup faces).

The selected six deep-tech startups from biotech-driven haircare (K18 Hair) to AI-enabled personalized cosmetics (Function of Beauty) and medtech wearables (Ōura) – all within beauty and health. And one non deep-tech startup (Bioklab) was included to increase analytical diversity. 7 case studies were selected to balance analytical depth and diversity within deep-tech health and beauty startups. A smaller number of cases would limit case comparison, while a larger sample would likely lead to repetitive findings without adding significant new insights. The chosen number allows for meaningful case comparison while maintaining detailed, context-specific insights. This diversity is greater than in typical case analyses (which often looked at one company or a single industry segment).

Table 2 Case studies

Case Study – 1	Pulsetto
Case Study – 2	Kriya Therapeutics
Case Study – 3	Function of Beauty
Case Study – 4	Bioklab
Case Study – 5	Ōura
Case Study – 6	OneSkin (Biotech for Longevity)
Case Study – 7	K18 Hair (Biotech for Hair Repair)

The selection of case studies is designed to fill the gaps by building on what is similar in prior work while explicitly addressing its limitations.

2.3.3 Previous case studies and their limitations

Previous academic research has explored deep-tech startups in the beauty and health domain, through case study analyses, but have tended to examine either technological development challenges (Kask & Linton, 2025) or social media marketing trends in isolation(Guo & Li, 2022). None of them provided a comprehensive, multi-faceted comparison of deep-tech startups in this sector specifically looking at their use of social commerce. For example, (Kask & Linton, 2025) conducted case studies on two robotics startups to examine deep-tech innovation and commercialization challenges. Their work highlighted typical deep-tech obstacles such as difficulty securing customers or margins but they did not address consumer-facing strategies like social commerce. In the health tech sector, (Soltani et al., 2022) analyzed the Oura smart ring, showing how user communities co-create value on social media platforms. While that study offered insights into customers engagement (users sharing health data and experiences online), it concentrated on consumer behavior rather than the startup's own marketing strategy. More broadly, literature on health and beauty deep-tech startups remains nascent – a 2021 scoping review noted that research

on how health-tech startups commercialize their innovations was largely "*missing*," with mostly anecdotal evidence available(Chakraborty et al., 2021). Much of the existing research in related domains focuses on generic digital marketing or influencer effects rather than deep-tech commercialization strategies. (Guo & Li, 2022) modeled how social commerce features (like interactivity and social support) drive consumers' perceived value and repurchase intentions on Chinese platforms. Such studies confirm that social-media-driven commerce can influence consumer behavior, but they do not delve into how deep-tech startups leverage these tools. Investigations in beauty and health sectors often examine influencer marketing outcomes or consumer trust in products without evaluating the startup's overall go-to-market approach. In summary, prior academic case studies and analyses in beauty/health tech have tended to examine either technological development challenges or social media marketing trends in isolation.

Research evaluate each startup on a comprehensive set of six criteria which goes beyond the narrower lenses used previously. For example, earlier deep-tech analyses emphasized technical hurdles and funding issues(Kask & Linton, 2025), whereas these studies incorporated consumer-centric factors like brand authenticity and trust. This important because deep-tech products usually have a hard-to-understand value proposition and long sales cycle, as noted by (Agarwal, 2024).

2.4 Quantitative Survey Research

2.4.1 Survey Design and Research Logic

The quantitative survey was designed to empirically test consumer responses to the social commerce mechanisms identified in the case study analysis. The research targeting consumers who use Instagram and/or TikTok for social commerce and who are familiar with the concept of deep-tech in beauty and health and search for such innovations. This means they follow influencers and their content, watch shoppable videos (reels, stories), purchase products via provided link to the shop, if possible, according to their location, use in-app shopping features. A survey is chosen because it allows collecting standardized data from a broad sample of users making it possible to quantitatively test relationships between key factors: platform usage, engagement, trust, purchase intention, to generalize findings to the wider population of social commerce users.

The full survey questionnaire is provided in annex: Survey - Deep-Tech Startups in Beauty and Health: Social Commerce Influence.

2.4.2 Variables and Measurement

For deep-tech startups entering the beauty and health market consumer acceptance is often hindered by skepticism or fear toward new products. Accordingly, the survey focuses on several key variables that reflect how social commerce can reduce these commercialization barriers. Each variable below is defined to improve awareness, trust, adoption, and engagement.

Awareness of Deep-Tech Products – measures how familiar consumers are with deep-tech beauty and health products, and whether they recognize these products as distinct from conventional offerings. Examines how aware and informed consumers are about deep-tech beauty/health products and whether social media helps them become aware of such innovations. These questions capture the efficacy of social media in spreading awareness. They align with the research objective of assessing whether social commerce expands consumer awareness of innovation.

Perceived Innovativeness **–** captures how consumers evaluate the novelty, uniqueness, and technological advancement of products from deep-tech startups. How consumers interpret the term "deep-tech" and whether knowing that a beauty or health product is developed using science-based or advanced technologies increases their willingness to consider or purchase it. It is measured by statements like: "*I think deep-tech startups in the beauty/health sector are more innovative than established brands*."; "*I find the idea of trying high-tech beauty or health products from new startups appealing."* By measuring perceived innovativeness, capture how novel or cutting-edge the consumer thinks the products are. A high perceived innovativeness can signal excitement and curiosity, whereas low perceived innovativeness might suggest that the novelty is not effectively communicated. Attitude is a known predictor of adoption: for example, a positive attitude often correlates with higher purchase intention in innovation adoption models(Sarker et al., 2025).

Trust in Deep-Tech Technologies via social commerce **–** assesses consumer trust of deep-tech solutions when presented via social commerce. This includes trust in the product's quality, brand's name and in the influencer as educator or presenter. Consumers often rely on peer reviews or influencer recommendations as proxies for credibility. It is measured by statements like: "*I trust the quality and safety of products from deep-tech beauty/health startups.*"; "*Products from deep-tech beauty/health startups that are promoted on social media seem credible and trustworthy to me*." Trust is crucial because social commerce environments that foster trust have been shown to increase purchase behaviors (Hermawan & Febranca Putri, 2025).

Consumer Engagement with Social Content **–** tracks behavioral interaction with deep-tech startups' content. This can include frequency of interacting with deep-tech product posts (likes, comments,shares, saves, follows) and time spent watching product videos. Survey items ask how often respondents interact with product content or how absorbed they feel by it: "*I follow at least one deep-tech beauty or health startup on social media.*". The engagement is expected to be a key driver of both trust and interest, as highly engaging content can build community and speed up adoption of new products.(Tuti & Sulistia, 2022).

Purchase Intention – reflecting the likelihood that a consumer will buy a deep-tech health/beauty product after encountering it on social media. It was measured with items such as "*I intend to buy a deep-tech beauty/health device if an influencer I follow recommends it on social media.*" or "*When I*

watch a product review video for an advanced beauty/health gadget, I am more inclined to buy that product." The higher scores indicate stronger purchase intentions.

Actual Purchase Behavior – captures whether consumers have previously purchased deep-tech products and whether social commerce played a role in that decision.

Platform Habits – establishes the respondent's social media engagement level, especially for product discovery. This encompasses how regularly the user uses Instagram for discovering new innovative health or beauty products or TikTok's product videos to find new beauty/health items. It captured via self-reports : "*Social media content has a strong influence on my decisions to try or buy new beauty/health products*.".

Content Type Influence – this refers to the impact of the type of content on consumer perceptions. Deep-tech products can be explained via short-form videos, live demos, influencer reviews, or static images and each format might affect trust and interest differently. The survey includes items to capture preferences : "*I am more likely to believe claims about a product after watching an influencer use it in a video, story or reels.*" vs "*I prefer reading about technical features in text form*". Particularly, interactive and user-generated content is expected to strengthen consumer trust and engagement, so measuring this helps assess what content strategy is most effective.(Niu, 2025).

Consumer Attitude toward Social Commerce – overall attitude or openness of the consumer to buying products via social media. For example, some users are very comfortable and even prefer shopping on Instagram/TikTok, while others are skeptical. Measured attitude with items such as "*I feel confident buying new or innovative products through social media*" or "*I trust shopping features on Instagram/TikTok (e.g. product tags, in-app checkout) for buying beauty/health items*." A more positive attitude is likely to correlate with higher purchase intention for the deep-tech startups' products.(Rachmad, 2022).

Barriers to Adoption **–** identifies perceived risks, hesitations, or limiting factors (price, skepticism, novelty, complexity) that may prevent consumers from buying deep-tech products via social media.

2.4.2.1 Hypotheses

Based on the previous variables, these six hypotheses have been formulated to test specific aspects of how social commerce contributes to the commercialization of deep-tech health and beauty startups. Each hypothesis is stated as a testable relationship between variables:

H1. Deep-tech startups can increase consumer awareness by actively using social media platforms.

H2. Deep-tech startups that use creative and engaging social commerce platforms achieve higher market visibility than those with limited social media engagement.

H3. Deep-tech startups can rely on social media platforms as their one of storytelling channels.

H4. Deep-tech startups that use social media platforms and their opportunities can increase their brand visibility and consumer engagement.

H5. Deep-tech startups that use social media can overcome communication barriers.

H6. Influencer testimonials on social commerce platforms have a positive effect on consumer trust.

2.4.3 Data Analysis Approach

Survey data are analyzed using descriptive statistics, including frequency distributions and percentage shares to identify dominant response patterns. Cross-tabulation is used where relevant to explore differences across demographic groups. This approach aligns with exploratory nature of the research and supports the fourth research objective. It focuses on evaluating how social platform features influence consumer engagement, trust-building, and brand visibility.

2.4.4 Previous surveys and their limitations

Analysis of prior survey studies on deep-tech beauty/health startups reveal notable limitations. Part of them rely on limited samples or narrow scopes, undermining generalizability. For example, an online survey of "*Beauty Tech—Customer Experience and Loyalty of Augmented Reality and Artificial Intelligence-Driven Cosmetics*" found an overrepresentation of young female consumers in one country (88% women, median age ~27), making results non-representative of the broader population "*Compared to the numbers for the German population, those numbers again are not representative* ".(Perret & Schwientek, 2025). The same demographic limitation was noted in "*Virtual Try-On cosmetics apps based on Augmented Reality (AR) technology*" research – "*To validate the findings across different demographics, future studies should include a more uniform sample, in both age and gender variables*." (Micheletto et al., 2025) Moreover, because participants couldn't physically test skincare devices, it was difficult for that study to capture real experiential benefits(Perret & Schwientek, 2025). They also did not look at how many marketing respondents seen or how familiar they were with technology, which could affect their opinions and choices(Maharani et al., 2025).

Research on wearable health tech during COVID-19 has some biases. Because people were more worried about their health at that time, the numbers for how many used these devices were probably higher than normal usage(Rha et al., 2022).

General social commerce surveys in beauty and health often focus on a single platform or subgroup. Researchers recommend such approaches to enhance generalizability – moving beyond single-platform data toward multi-platform studies is urged so that findings hold under different platform logics and user behaviors (Zuo et al., 2025), (F. Herzallah et al., 2025). One Instagram-based study of cosmetic brand engagement, for instance, had 203 respondents on just one platform, without considering other social channels or product categories (Duh & Moodley, 2025).

Influencer's marketing research typically targets a narrow audience (for example millennial Instagram followers) and may not capture variations across newer platforms or emerging product types. In addition, many tech adoption studies in healthcare explore AI in general terms and often

rely on samples that lack diversity and "*some respondents were not completely aware of AI technology*"(Esmaeilzadeh, 2020). Collectively, these survey suffer from narrow populations, limited construct coverage, lack of emerging-tech context, and unclear platform targeting, leaving theoretical and methodological blind spots.

Earlier research did not explicitly investigate emerging deep-tech beauty and health innovative products, such as AI-powered skincare diagnostics, biotech-based cosmetics, or wearable beauty/health devices. The current survey is designed to fill important gap. In previous works, researchers highlight a significant lack of research on cutting-edge AI applications in cosmetics retail, underscoring that trust and adoption of AI-driven beauty innovations remain under-studied areas (Adawiyah et al., 2024; Ameen et al., 2021). For instance, a 2025 study on consumer trust in AI within the UK and Ireland's personal care and cosmetics sector explicitly notes, "*Existing studies primarily focus on AI in broader e-commerce contexts, yet there is a lack of research examining how trust in AI develops specifically within the cosmetics industry.*" (O'Higgins & Fatorachian, 2025). This gap justifies a survey focusing on these new tech-enabled products.

In research it is crucial to measure constructs like trust, engagement, usage, and purchase intention distinctly and comprehensively. However, many prior studies failed to capture all of these constructs or merged some of them. A recent systematic review found that different studies defined and operationalized *trust* and *engagement* inconsistently, making it hard to compare results and indicating a lack of uniform, clear measurement (Ahmad et al., 2025).

Designing a survey that spans multiple social platforms, targets specific emerging deep-tech products, and includes a diverse sample of respondents directly addresses the above weaknesses. By incorporating several platforms, focusing on the new deep-tech beauty and health innovations that were previously overlooked, the survey will produce more robust, widely applicable insights and explore how the combination of social commerce and deep-tech startups in beauty and health sectors could be a strategic solution for commercialization. The current research leverages a structured questionnaire to capture users' perceptions and behaviors.

2.5 Integration of Empirical Methods

The strength of this empirical research lies in the integration of qualitative and quantitative methods. Case studies provide contextual understanding of how social commerce is implemented by deep-tech startups, while survey results validate whether these practices resonate with consumers.

Together, these methods form a coherent analytical framework:

- Case studies explain why social commerce is used and how it works;
- The survey demonstrates how consumers respond to these practices.

This integrated approach ensures that the empirical findings contribute to a unified understanding of social commerce as a strategic commercialization tool for deep-tech startups, rather than treating the methods as separate or unrelated analyses.

2.6 The reliability of the research

Ensuring the reliability and validity of the research several steps were taken to enhance the trustworthiness of the survey and the data collected:

At the beginning of the survey a clear and concise description of the study was provided, along with essential information about the author and the educational institution. Introducing the author and their academic affiliation increases the credibility of the research. This is considered good practice and is commonly recommended in academic research ethics guidelines.

Before launching the main public survey, a pilot test was conducted with a small group of participants (10 individuals who resemble the target population). The pretest serves to identify any ambiguities or biases in the questions, ensuring that respondents interpret them as intended. Any confusing wording revised, and overly complex questions adjusted based on the pilot feedback (Hashim et al., 2022).

The survey is structured with closed-ended questions, which makes it possible to collect structured data that is easier to analyze. Closed-ended questions are effective for obtaining quick and clear responses.

Apart from survey instrument reliability, the reliability of the results was also considered. While the study is cross-sectional, the aim is for transparency in the methodology so that future researchers could reuse the survey. By clearly defining the sampling method, measures, and analysis techniques. All procedures were documented, from how the survey was distributed to how variables were constructed.

The survey ensures ethical standards – informed consent is obtained (the introduction explains the purpose and that participation is voluntary and anonymous), and data is kept confidential. This encourages honest and reliable responses, as participants feel secure about how their data is used.

2.7 Data collection method

The analysis of scientific literature shows that to understand how social commerce platforms like Instagram and TikTok can build trust and educate potential customers to support the commercialization efforts of health and beauty deep-tech startups, an online survey is one of the most appropriate research methods. The questionnaire, as the survey instrument, is prepared based on the theoretical part of the study and follows best practices for survey design. The questionnaire consists of clear and specific closed-ended questions, ensuring respondent anonymity while reducing the risk of superficial answers. The survey includes:

a) demographic items (such as age, gender) and usage patterns (for example, frequency of Instagram/TikTok use);
b) Likert-scale items to measure key constructs;
c) Four multiple-choice questions;
d) Six yes/no questions.

Likert items use a 5-point agreement scale (1 = Strongly Disagree to 5 = Strongly Agree) to capture the extent of agreement with statements about the startup's products or the platform experience. The questionnaire is distributed online via a survey link, and responses are recorded digitally for analysis. The study follows a cross-sectional design, capturing a snapshot of consumer perceptions at one point in time.

Data processing methods

After data collection, the responses are cleaned and then analyzed. The analysis proceeds in several steps.

First, descriptive statistics are used to summarize the data and understand the sample characteristics and general trends. This includes calculating frequencies and percentages as well as measures of central tendency for key variables. For each Likert-scale construct (awareness, trust, engagement, etc.), the mean score (average) and standard deviation are calculated. These descriptive indicators provide an initial sense of how strongly the sample, on average, feels about each construct. For example, an average purchase intention score of 4.2/5 indicates generally high intent.

Before testing hypotheses, internal consistency of multi-item scales is ensured. Cronbach's Alpha was calculated for each construct (trust, engagement, etc.) as a measure of reliability (internal consistency). Cronbach's alpha essentially evaluates how closely related a set of items is as a group. Its value ranges from 0 to 1.

To test the bivariate relationships posited in the hypotheses (especially for continuous variables like trust and purchase intention), Pearson's correlation coefficient is used. This statistic measures the strength and direction of the linear relationship between two variables.

Cluster analysis (segmentation) is used to identify distinct consumer segments among social commerce users based on attitudes/behaviors (Awareness, Engagement, Trust, Innovativeness, Platform Usage), to profile who is most receptive to deep-tech beauty/health products.

Throughout the analysis, Standard indicators are used to interpret results. Descriptive indicators like mean differences or cross-tabulations for context (for instance, showing what fraction of the sample actually made a purchase after seeing a product on social media). These descriptive insights complement the hypothesis testing by sketching a profile of user behavior in social commerce.

2.8 Size of the selected sample and sampling method

The target population is social media users – millennials and Gen Z in particular. Millennials are generally defined as those born between 1981 and 1996, which means they are currently aged between 29 and 44 years old as of 2025. Gen Z is generally defined as those born between 1997 and 2012, which means they are currently aged between 13 and 28 years old as of 2025 (Locke et al., 2022; Slepian et al., 2023). The target population is those who have experience with health or beauty products on Instagram or TikTok. These include following beauty/health influencers, viewing product demonstration videos, and purchasing products via links provided to e-shops or using features like Instagram Shopping and TikTok Shop. The survey was distributed online via social platforms (posting the survey link on Instagram stories, TikTok posts, and relevant online communities or social groups) to reach participants who fit the criteria. A screening question "*Have you used Instagram or TikTok to discover or purchase a beauty/health product in the past 6 months?*" ensure respondents are indeed social commerce users. The goal is to obtain a sample size of approximately ≈ 100-120 respondents, which is sufficient for analysis and similar to sample sizes used in related studies (Arifin et al., 2024; Dinzki Al-Jundi & Ardansyah, 2024; Reineta & Utami Tjhin, 2023; Shridhar et al., 2023). While not a random sample, efforts was made to include a diverse range of ages, genders, and backgrounds within the target demographic to improve representativeness. Each participant completes the survey anonymously and voluntarily, typically taking about 10 minutes.

3 RESEARCH AND ANALYTICAL PART

3.1 Case Studies description

These case studies showcase the diverse startups of biotech, medtech and personalized health innovation. Pulseto uses non-invasive vagus nerve stimulation to reduce stress and enhance mental well-being, while Kriya Therapeutics develops gene therapies that target the root genetic causes of chronic diseases. Function of Beauty applies data-driven customization to create individualized hair, skin, and body care products, and Bioklab focuses on microbiome-based diagnostics and personalized wellness solutions. Ōura offers a smart ring that tracks sleep, readiness, and activity to optimize daily performance and overall health. OneSkin leverages peptide-based biotechnology to slow skin aging and extend skin longevity and K18 Hair uses bioengineered peptides to repair hair damage at the molecular level, redefining hair care through biotech innovation.

3.2 Case Study nr.: 1 – Pulsetto

Startup Profile Description

Pulsetto was founded in 2021 in Vilnius, Lithuania, by co-founders Povilas Sabaliauskas (CEO) and Vitalijus Majorovas (Head of Business Development & Strategy). The duo met through the EIT Health community, driven by personal motivations.(Pulsetto, 2025). The company has grown to 39-50 employees, including experts in sleep science, neuromodulation, engineering, and clinical trials, with a headquarters in Vilnius and a focus on global expansion. As of 2025, Pulsetto has raised $2.69M across three seed funding rounds, achieving a $21M valuation, and reports $4.1M in annual revenue with over 100,000 customers(Garcia, 2025; Palchynska, 2025; *Pulsetto - News & Analysis*, 2025). Its main product focus is the Pulsetto device – a compact, app-controlled wearable that delivers non-invasive VNS for stress reduction, sleep improvement, and mental wellness, positioning the startup as a leader in consumer neuromodulation(Machetanz et al., 2021).

Core technology or innovation type

Pulsetto's innovation centers on non-invasive transcutaneous cervical vagus nerve stimulation (nVNS), a deep-tech neuromodulation approach that uses low-level electrical impulses (via ultra-low radio frequency energy) to target the vagus nerve – the body's longest cranial nerve, which regulates the parasympathetic "rest and digest" system. The device, worn around the neck, delivers personalized sessions (4-10 minutes) through gel pads, stimulating neurotransmitter release like acetylcholine and serotonin to reduce cortisol, enhance heart rate variability (HRV), and promote relaxation without surgery or pharmaceuticals. This biotech-inspired technology draws from electroceuticals, a emerging field blending electrical engineering and neuroscience(Pulsetto, 2025).

Target market and customers

Pulsetto targets the $1.5 trillion global wellness market, focusing on adults aged 25-55 suffering from chronic stress, anxiety, poor sleep, and burnout. Primary customers include urban professionals, athletes (NBA star Domantas Sabonis uses it for recovery), and postpartum parents

seeking non-pharmacological relief. The B2C segment emphasizes individual biohackers via direct-to-consumer sales, while B2B targets wellness clinics, corporate wellness programs, and healthcare providers for bulk distribution(Garcia, 2025; Pulsetto, 2025).

Commercialization strategy

Pulsetto employs a hybrid direct-to-consumer (D2C) model, launching via a record-breaking 2021 Indiegogo crowdfunding campaign that raised $400K on day one – one of Lithuania's top three. Core strategy involves e-commerce sales through pulsetto.tech, bundled with app subscriptions for personalized protocols (stress, sleep modes), and HSA/FSA compatibility for U.S. tax savings (30-40% off). Pricing starts at $269 for the device, with upsells like premium gels(ACCESS newwrite, 2025; *Pulsetto - News & Analysis*, 2025). Global scaling includes EU manufacturing for cost efficiency and targeted Black Friday promotions (up to 50% off in 2025). B2B expansion via wholesale and affiliate programs offers 20-30% commissions to influencers and distributors, aiming for 100M users by integrating into healthcare ecosystems. This lean, digital-first approach has driven 10x revenue potential, per Lithuanian startup analyses (ACCESS newwrite, 2025; Briggman, 2025; Garcia, 2025; Pulsetto, 2025).

Social commerce platforms used

Pulsetto leverages Instagram, TikTok, LinkedIn, and YouTube for social commerce, integrating shoppable posts and live demos to drive of traffic. Instagram reels showcase user transformations (such as: "*60% anxiety reduction*" testimonials), capitalizing on visual storytelling for wellness audiences, with user-generated content collaborations with U.S. creators: biohackers like Brian Johnson, and best-selling authors like Peter Diamandis, Ben Greenfield, and Max Lugavere(Palchynska, 2025). Pulsetto content creators (often micro-influencers) are also effective at driving conversions. Industry data confirm that video content co-created with relatable creators resonates deeply with wellness audiences, who trust these voices for health advices(Austin, 2024). TikTok targets Gen Z via short-form challenges (#VagusNerveHack, 1M+ views), emphasizing quick stress-relief demos to boost virality. Short-form demos (such as breathing exercises) fit this mold. Scientific work confirms that brief video lessons on relaxation can improve well-being(C. Liu et al., 2025). In practice, Pulsetto TikTok stress-relief clips and challenges leverage this effect. By packaging breathing and recovery tips into viral clips, they tap TikTok's algorithm and Gen Z's love of quick, authentic content (Chaves, 2024).

Influencers and NBA stars Domantas Sabonis, Jonas Valančiūnas, Mantas Buzelis partnership in 2025 drove significant visibility(Palchynska, 2025; Pulsetto, 2025). Also Pulsetto have partnerships with influencer Bryan Johnson, featured in Netflix's documentary *Don't Die(imdb.com, 2025)*. LinkedIn focuses on B2B networking with execs in health tech, sharing trial updates for credibility. YouTube hosts podcasts (e.g., with athletes) for long-form education(youtube.com, 2025).

Challenges in Commercialization

Pulsetto is confronting several commercialization obstacles both of them technological and market-oriented. On the technological side, while its wearable vagus-nerve stimulation (VNS) device has garnered consumer interest, it still lack extensive, peer-reviewed clinical data verifying long-term efficacy and safety in non-clinical settings – which risks limiting adoption, credibility and acceptance by healthcare professionals(Pulsetto, 2025). From a market barrier standpoint, Pulsetto faces the challenge of transitioning from the wellness segment into regulated medical applications –which introduces higher regulatory hurdles, certification demands and sales-cycle complexities (Lawrence, 2025; Palchynska, 2025). Furthermore, positioning a novel neuro-device in a crowded wellness marketplace means navigating consumer skepticism, establishing a clear value proposition versus alternative stress- or sleep-tech options, and building the requisite distribution and partnerships for global scaling(Palchynska, 2025; Wood, 2025).

3.3 Case Study nr.: 2 – Kriya Therapeutics

Startup Profile Description

Kriya Therapeutics is a clinical-stage biotechnology startup founded in 2019. It maintains dual headquarters in Silicon Valley (Redwood City, CA) and Research Triangle Park, NC(Synapse by patsnap, 2025). The company has raised several rounds of financing total well over $600 millions.(Kriya, 2025). Kriya's core focus is on gene therapy. Developing one-time genetic treatments for common chronic diseases(rather than only rare disorders)(Peter, 2025). Its pipeline includes therapies for chronic ophthalmic, metabolic and neurological diseases. For example, lead programs target geographic atrophy of retina, thyroid eye disease, type 1 diabetes, metabolic liver disease, and trigeminal neuralgia(Kriya, 2025; Manalac, 2025). Kriya Therapeutics company emphasizes an integrated development strategy that why their products portfolio is built on an end-to-end gene therapy platform that spans R&D through manufacturing.

Core technology or innovation type

Kriya's Therapeutics deep-tech centers on advanced gene-therapy engineering and computational biology. Its proprietary platform uses AI and machine learning for rational vector design: a cloud-based engine ("SIRVE" among other tools) integrates high-throughput screening and sequencing data to optimize viral constructs for safety and efficacy. In practice, Kriya designs novel adeno-associated-virus (AAV) vectors. Also it engineered genes that can be delivered directly to target tissues. The company also invests heavily in next-generation manufacturing: it operates in-house GMP bioreactors (up to 2000L scale) and state-of-the-art cell-culture facilities to mass-produce viral therapies. This integrated "*gene therapy engine*" (combining biotech, bioengineering and AI) is intended to improve speed, reduce cost, and increase consistency of gene-therapy production(Kriya, 2025; Pharmaceutical Technology, 2025; Synapse by patsnap, 2025).

Target market and customers

Kriya Therapeutics aims at large patient population suffering from chronic disorders that have unmet medical needs. Its stated mission is to expand gene therapy into "*common and highly prevalent conditions affecting millions of patients worldwide*"(Synapse by patsnap, 2025). Accordingly, its lead programs target chronic diseases. These diseases represent broad markets (e.g. their target auditory are millions of diabetes or macular degeneration patients) that today require lifelong treatments(Kriya, 2025; Manalac, 2025). In effect, Kriya's Therapeutics customers are the healthcare systems, doctors and patients in these segments – with the end goal of delivering one-time, durable therapies. It also partners with academic and industry collaborators to develop specific assets (e.g. a licensing deal with MUSC for an ophthalmic therapy, acquisitions of Redpin and Warden Bio to access neurology and rare-disease programs)(Peter, 2025).

Commercialization strategy

Kriya's Therapeutics commercialization approach is to own the end-to-end process of bringing gene therapies to market. The company has built an integrated platform combining R&D, clinical development, manufacturing(Kriya, 2025). It scales this platform by both internal innovation and targeted partnerships and acquisitions. For example, Kriya has acquired biotech startups: Redpin for chemogenetics and Warden Bio for rare liver diseases. Furthermore they entered academic collaborations with MUSC for retinal gene therapy to expand its pipeline(Peter, 2025). At the same time, it is commissioning a large production facility to support clinical and commercial manufacturing(Kriya, 2025; Peter, 2025). Investors note that Kriya 's Therapeutics "*fully integrated CMC engine*" (chemistry, manufacturing, controls)is intended to overcome historical bottlenecks in gene therapy scale-up(Kriya, 2025). Kriya Therapeutics seeks to accelerate time-to-market by coupling in-house computational design and manufacturing with strategic deals, ultimately delivering its therapies into high-volume disease markets.

Social commerce platforms used

Kriya Therapeutics is active on professional social networks. Its official communications and press releases link to a company LinkedIn page (*Kriya Therapeutics (@kriyatx) / X*, 2025) and Twitter account(*Kriya Therapeutics, Inc.: Overview | LinkedIn*, 2025). These channels are used to announce funding news, scientific updates, and recruitment (Kriya, 2025). For example, press materials instruct followers to "follow us on LinkedIn" and "Twitter" for updates.

In comparison with Pulsetto and others, Kriya does not prominently leverage consumer platforms like Instagram or TikTok for its B2B/B2C audiences. The focus on LinkedIn/Twitter reflects their very professional attitude of the biotech market: these networks more help engage investors, industry partners, researchers and potential employees.

Challenges in Commercialization

Kriya's Therapeutics innovations faces several technical and market barriers. Gene therapy as a modality is inherently expensive and complex, even Kriya's leadership observes: "*We believe gene therapy has the potential to redefine medicine over the next decade. However, the field has been*

constrained by technological and operational challenges that make it difficult and expensive to deliver new products," said Shankar Ramaswamy, M.D., Co-Founder and Chief Executive Officer of Kriya. High manufacturing costs and scale-up issues are widely recognized hurdles (Kriya explicitly aims to "reduce manufacturing costs and enhance scalability" of gene therapies(Synapse by patsnap, 2025)). In practice, producing clinical-grade viral vectors at multi-thousand-liter scale with consistent quality is nontrivial. Further, regulatory and safety headwinds loom large, the broader gene-therapy industry has seen recent setbacks (FDA restrictions on other therapies, reports of patient adverse events)(Manalac, 2025). Kriya's Therapeutics own candidate modalities (suprachoroidal eye injections, novel ion channels in the CNS) will require extensive clinical validation. The market context is challenging: approvals can take many years (often over a decade) and therapies may cost in the millions, making payers cautious(Peter, 2025). Kriya Therapeutics must surmount technical scale-up and cost barriers(Synapse by patsnap, 2025), navigate a stringent regulatory environment(Manalac, 2025), and demonstrate clear benefit to achieve success in commercialization.

3.4 Case Study nr.: 3 – Function of Beauty

Startup Profile Description

Function of Beauty startup was founded in 2015 by Zahir Dossa, Joshua Maciejewski, and Hien Kaplan, and is headquartered in New York (CBinsights, 2020; Ycombinator, 2025). The company currently employs approximately 300 people. Function of Beauty is a customized beauty brand at the intersection of tech and beauty, offering customizable beauty products for hair, skin, and body care (Ycombinator, 2025). The company was created by beauty outsiders: two grads and a chemist who believed that everyone deserves a custom product and should be empowered to create their own beauty journey (Ycombinator, 2025). The startup has raised significant funding over multiple rounds. Function of Beauty raised a total of $164.66 million funding (CBinsights, 2020), with a $150 million strategic minority investment in December 2020(PR Newswire, 2020).

Core technology or innovation type

Function of Beauty's deep-tech innovation centers on AI-powered algorithms and advanced manufacturing automation for mass customization at scale. Function of Beauty's machine-learning algorithms factor in all the variables from customer quiz responses and concoct the most effective recipe for personalized products (Mann, 2018). The chance of answering the 12-question hair quiz exactly the same as another person is 1 in 24 billion, and the formulating algorithm is designed to randomly vary a component, even by a gram, so that no two bottles would be identical (Mann, 2018). This deep-tech application integrates data-driven methods to tailor products to individual needs and preferences, including hair texture, goals, fragrance, and color. The company's proprietary algorithm and manufacturing technology enable scalable customization which is rare in beauty(BeautyMatter.com, 2023). What distinguishes Function of Beauty from competitors is that it

removes manual labor from the manufacturing process to enable personalization(R. Brown, 2020). A robotic automation dispenses specific amounts of each component, using anywhere from 20 to 50 inputs per bottle, sourcing from 500 different ingredients (R. Brown, 2020).

Target market and customers

Startup's target consumers are users who seeking highly personalized beauty products, especially men and women who want hair and skin care solutions tailored to their unique needs. This audience is typically knowledgeable about ingredients and values bespoke formulations over one-size-fits-all options. The market includes consumers comfortable with online customization experiences(BeautyMatter.com, 2023; Ycombinator, 2025).

Commercialization strategy

Function of Beauty primarily employs a direct-to-consumer e-commerce model, building intimate customer relationships through its website and offering both one-time purchases and subscription services. In addition to its direct-to-consumer platform they also offering distinct product lines at different retailers, including its new *Pro* collection at Sephora's website and in 300 US and Canada stores, alongside products at Target stores(Barkho, 2023). This multi-channel approach broadens their reach while maintaining the premium customization segment at the top of their brand pyramid. (Barkho, 2023; BeautyMatter.com, 2023). Also, the brand announced partnerships with Amazon and most recently, Walmart for wholesale growth(Howland, 2025).

Social commerce platforms used

The company leverages social commerce heavily, particularly Instagram and TikTok. Instagram serves as a primary platform for company's marketing. Instagram is perfect for showcasing the aesthetics of Function of Beauty products, curating their feed to reflect their uniqueness using high-quality photos, reels, and stories(instagram.com, 2025). TikTok contributes through viral challenges (e.g. #ShampooShakeUpChallenge) and influencer content, which boosts product discovery significantly(tiktok.com, 2025). Influencer partnerships with niche beauty creators like Jessica Morrobel, Reagan Baylee, Lauren Wilensky and others help Function of Beauty build relationships that go beyond simple product placements to create meaningful brand alignment and community engagement(Modash, 2025). Specifically targeting influencers within the beauty and haircare topics who can authentically connect with their audience.

Challenges in Commercialization

Key challenges include regulatory barriers in international expansion, such as animal-testing laws in China and strict ingredient testing and certification requirements in the EU, which limit market entry (Sandler, 2019). Also manufacturing and scalability challenges, while there is customer desire for personalized products, there is still significant investment required to enable efficient manufacturing of personalized goods(Salpini, 2021). Additionally, maintaining the technological edge of hyper-personalization while scaling production and addressing diverse market preferences poses ongoing operational and market challenges (Sandler, 2019; Ycombinator, 2025).

3.5 Case Study nr.: 4 – Ōura

Startup Profile Description

Ōura Health is a deep-tech startup in health sector and founded in 2013 and located in the US. Ōura Health current focus on wellness wearable rings that monitor sleep, recovery, activity and key biometrics (heart rate, temperature, respiratory rate, etc.)(McDowel, 2022; Wong, 2023). The company is sized as a mid-size startup, raised over $900 millions in funding recently with valuation reaching around $11 billions as of late 2025 (Medical Device Network, 2025). Their main goal is "*to transform personal health and wellness using innovative wearable technology"* (Hughes, 2025) and the product focus is the Oura Ring, which is a smart ring that integrates advanced sensors to track multiple health metrics and provide personalized wellness insights to users (Hughes, 2025; Shibu & Thomas, 2025). The ring has sold millions of units (over 2.5 million by late 2024) (Chiquoine, 2024).

Core technology or innovation type

The core technology and Ōura's innovation is sensor-based biometric monitoring combined with advanced data analytics. The ring embeds LEDs (infrared, red, green) and photodetectors to perform photoplethysmography(PPG), inertial motion sensors, temperature sensing, and AI-driven health data interpretation (Medical Device Network, 2025; ocsportsandwellness.com, n.d.) By shining light through the finger and measuring the reflection. It derives heart rate, heart-rate variability (HRV), blood oxygen, and even subtle skin-temperature changes(Taylor, 2025).

The deep-tech aspect lies in the integration of physiological sensing hardware with sophisticated algorithms for sleep analysis, readiness scores, and recently added continuous glucose monitoring features by partnering with Dexcom's CGM device(Medical Device Network, 2025). All data are sent via Bluetooth to user Ōura smartphone app, where algorithms and AI models analyze them (Hughes, 2025).

Target market and customers

Ōura's target market is primarily health conscious, tech savvy individuals aged 25-44, typically middle to high-income urban professionals. Their CMO says "*We have designed our product to be accessible for all*" and that the "*target consumer is anyone dedicated to understanding and improving their health and wellness*" (Chiquoine, 2024). Their customers include everyday wellness users, biohackers, athletes and even government agencies like military health research units.(Shibu & Thomas, 2025; Wong, 2023). Ōura's recent growth has been driven by women's health and younger users, CEO Tom Hale reports that "*women have flocked to Ōura and it's driven our growth through the roof".(O'Brien, 2025)* Their marketing campaigns now focus and on Gen Z and millennial audiences, "*which <…> marks a pivot from the brand's previous focus on men and older customers"*(Nguyen, 2025).

The company's largest market is in US, but the ring is sold in over 20 countries worldwide and focuses on business-to-consumer (B2C) primarily, with growing business-to-business (B2B) collaborations (Shibu & Thomas, 2025; Wong, 2023). For example, rings are used by hospitals,

banks, large employers and professional teams (NBA, WNBA, even Aston Martin Formula 1) to monitor employee or athlete health status(Hughes, 2025).

Commercialization strategy

They began with crowdfunding and product launches at tech conferences(Hughes, 2025). Now Ōura employs a hybrid strategy combining direct-to-consumer online sales and strategic retail partnerships with major outlets like Amazon and Target (chains like John Lewis in Europe) to broaden accessibility and brand visibility(Chiquoine, 2024). They also expanded into B2B sales by launching an “Oura for Business” platform, which offer corporate wellness analytics, and it has struck licensing deals with organizations from casinos to sports leagues(Hughes, 2025).

They emphasize digital marketing, content, and social media presence alongside health and lifestyle brand collaborations. They leverage strategic partnerships, like a 2022 Gucci “smart ring” co-brand and a Dexcom integration for blood sugar tracking (Hughes, 2025). Recent funding rounds fuel international expansion and innovation in product features, driving sales growth and new health-centric capabilities integrated into ring, its app (Ozan, 2025; Wong, 2023).

Social commerce platforms used

Ōura leverages social commerce platforms such as Instagram, TikTok, Snapchat, choosing them for their suitability in targeting younger, health-interested demographics (intagram.com, n.d.; tiktok.com, n.d.). They have used influencer and celebrity endorsements partnerships with Jennifer Aniston, Prince Harry, athletes, etc. to boost visibility. Also user-generated content, and aesthetically pleasing advertising formats. In addition, Ōura maintains a presence on Facebook, Pinterest and LinkedIn for paid ads, as well as Twitter (X) and Reddit, depending on the audience (Chand, 2024).Brand uses YouTube, TikTok and Instagram to share health/technology content and build community through polished content(Chand, 2024; Nguyen, 2025). While TikTok supports viral reach and engagement with health-related trends and video challenges.

Challenges in Commercialization

One of main commercialization challenge include reliance on a single product line – the Oura Ring. Which exposes risks if market preferences shift or cheaper competitors emerge. Their historically limited distribution (mostly direct online sales) constrained rapid scaling, though recent retail partnerships mitigate this (Chiquoine, 2024; Hughes, 2025). But barrier of competition appears from major consumer tech firms like Apple, Fitbit, WHOOP that offer a wider or cheaper products ecosystem (Wong, 2023). As with any consumer wearable device, technical barriers appear as well – accuracy and regulatory status. Independent studies show Ōura is excellent at basic metrics (high accuracy for resting HR and HRV(Dial et al., 2025)) but only moderate at detailed measures. For example, one clinical study found Oura’s sleep-stage classification accuracy was only ~53-58% (Herberger et al., 2025).

3.6 Case Study nr.: 5 – OneSkin (Biotech for Longevity)

Startup Profile Description

OneSkin was founded in 2016 by team of four Brazilian female PhD scientists. The company is based in San Francisco, California. Currently have about 50 employees (PR Newswire, 2024; SignalHire.com, n.d.). OneSkin positions as a biotech skincare startup focused on skin longevity. Their core product line is built around OS-01 (a proprietary peptide formulated into topical skin supplements). The brand claims this peptide "*is the first peptide scientifically proven to reverse skin's biological age by preventing the accumulation of senescent cells*"(PR Newswire, 2024). OneSkin markets a range of infused facial and body treatments designed to "*boost cells' functionality to optimize skin longevity*"(PR Newswire, 2024). They launched these products initially online in 2021. And now receiving thousands of customer testimonials and clinical study data in support of its efficacy(PR Newswire, 2024; Stern, 2024).

Core technology or innovation type

The main innovation is the patented OS-01 senotherapeutic peptide - a biotech molecule targeting cellular aging. In laboratory and clinical tests, OS-01 has been shown to reduce senescent cell buildup and effectively reduce biological age of the skin by blocking inflammation pathways (Bosslett, 2025; Zonari, Brace, Al-Katib, et al., 2024; Zonari, Brace, Harder, et al., 2024; Zonari et al., 2023, 2025). This peptide approach is novel in skincare sector and OneSkin claim they are the first company that replicates skin aging in the lab to validate such effects.(oneskin.co, n.d.).

OneSkin also developed *MolClock*, it's a proprietary skin-specific "molecular clock" algorithm. MolClock uses DNA methylation patterns in 3D skin models to quantify sample's molecular age. This genomic analysis lets OneSkin measure how treatments (including OS-01)affect skin age at a cellular level. The company's R&D leverages 3D human skin cultures and advanced genomics to discover and validate active ingredients. Their deep-tech approach combines biotech and computational biology to tackle skin aging (oneskin.co, n.d.).

Target market and customers

OneSkin targets health and beauty conscious adults concerned with aging and longevity. Consumers value longevity and vitality over mere cosmetic promises, so OneSkin focuses to the intersection of the beauty and health market. People who want products that are both effective and scientifically credible are their main target audience. (*Longevity Skin Care Gets a Boost with OneSkin Investment Round | Global Cosmetic Industry*, 2024; oneskin.co, n.d.). Initial markets are primarily the United States, with planned expansion into Canada and the UK. The company's primary distribution is direct-to-consumer e-commerce through its own website and Amazon – selling via subscriptions and online retail(BeautyMatter.com, 2024; GlobalCosmeticNews.com, 2025).

Commercialization strategy

OneSkin markets itself on strong scientific validation. It emphasizes clinical research published in journals like npj Aging and Journal of Cosmetic Dermatology, and laboratory studies.(PR

Newswire, 2024). This evidence-based approach is used widely in advertising. They also collect customer testimonials and before/after data to reinforce their claims.

OneSkin relies on a subscription based DTC model. By selling directly through its website, the company controls branding and captures recurring revenue – a strategy that has yielded "*unprecedented retention*" in a category where customers usually churn every few months(BeautyMatter.com, 2024).

Social commerce platforms used

OneSkin actively engages consumers on popular social media channels – Instagram, TikTok, Facebook, Pinterest. Company leverages social media influencers like Hannah Crews, Okikiola Emaleku, Dan Wootton Outspoken to create engaging content and provide reviews of the products.(Modash, 2025). Participates in longevity conferences and creates partnerships (e.g. participation in biotech accelerator IndieBio) to reach the audience(*Homepage - IndieBio - #1 in Early Stage Biotech*, n.d.). They gained notice among high-profile celebrities like Katy Perry and models like Georgia May Jagger and leading longevity advocates like Dr. David Sinclair, Tony Robbins, reflecting its appeal to the celebrity and wellness influencer segment(Burns, 2024).

The brand uses TikTok to post educational content and product demos, video explainers of OS-01) to attract beauty-savvy and "biohacking" audience(*One Skin (@oneskin.Co) | TikTok*, n.d.). Pinterest is likely used to share infographics and skincare tips. (pinterest.com, n.d.).

Challenges in Commercialization

The longevity-skincare market is still niche and many consumers are wary of anti-aging claims. They must overcome the overwhelm of traditional marketing rhetoric by educating users about cellular aging and presenting hard and scientific data. (*Longevity Skin Care Gets a Boost with OneSkin Investment Round | Global Cosmetic Industry*, 2024).

By choosing to sell cosmetics (topical supplements), OneSkin avoids lengthy drug approvals, but it still must meet strict safety and labeling regulations. All new molecules must pass battery tests for toxicity and comply with cosmetic rules.The skin-care industry is highly competitive, with many established brands. Convincing consumers to try a novel biotech product is difficult. OneSkin acknowledges that skincare customers often switch products every few months out of dissatisfaction, that's why building loyalty is hard in this category.(BeautyMatter.com, 2024).

3.7 Case Study nr.: 6 – K18 Hair (Biotech for Hair Repair)

Startup Profile Description

K18 Hair is a biotech-powered haircare startup founded around 2020 headquartered in San Francisco, California, USA, based in the beauty and personal care sector. K18 Hair has grown into a mid-sized company. They are serving customers worldwide, including professional hairstylists and at-home users. Their main product focus is on molecular hair repair treatments that restore hair health using advanced biotechnology designed to reconnect damaged hair at a molecular level. (*K18*

Hair Company Information, Funding & Investors | Dealroom.Co, n.d.; *The "Why" Behind K18 | K18 PRO*, n.d.). Its flagship items include a Leave-In Molecular Repair Hair Mask and related oil and shampoo products, all built around the patented K18Peptide™.

Core technology or innovation type

K18's innovation is firmly in the biotechnology/biomimetics space. Its signature ingredient, K18Peptide™(developed through over 10 years of bioscience research), is a synthetic peptide engineered to mimic human keratin. (k18hairpro.com, 2024). This deep-tech biotechnology copy hair biology to penetrate hair's inner layers and reconnect broken polypeptide chains and disulfide bonds damaged by chemical, heat, and bleach treatments. Effectively reversing hair damage from the inside out within minutes.(k18hairpro.com, 2024). This approach contrasts with traditional cosmetic coating, aiming for true repair rather than surface conditioning.

Target market and customers

K18 primarily targets professional hairstylists as well as end consumers with damaged hair who seek best premium repair solution. Ther consumer surveys show heavy Gen Z and Millennial adoption of their products.(Goodwin, n.d.) Their approach strongly involves hairstylist endorsement and education, expanding to consumers through digital and social channels. The market focus is global with collaborations with beauty salons and at-home use across 100 countries.(Goodwin, n.d.; Lorincz, 2023).

Commercialization strategy

K18 has pursued a hybrid go-to-market (commercialization) strategy, utilizing both professional salon channels and consumer retail/e-commerce platforms. At the beginning, the company certified select salons to use their treatment, positioning K18 as a premium in-salon service(k18hairpro.com, 2024). In 2021, K18 expanded into wider retail, notably Sephora. At the same time they started communication with viral TikTok campaigns (*K18 Hair (@k18hair) | TikTok*, n.d.; *Tech Transformation Podcast: K18 CEO Suveen Sahib On Social Commerce Strategies | Consumer Goods Technology*, 2022). And it changed everything completely. (Lorincz, 2023). Today its distribution covers professional salons, high-end beauty retailers and its own online store.

Their commercialization relies heavily on digital marketing and direct-to-consumer tactics. For example, founder Suveen Sahib emphasized a "pro-first education" approach and a strong digital presence, including reality experiences, live science events, and educational content(Pile, 2022). In practice, the startup invested heavily in creating valuable and engaging content to grow their brand: TikTok viral videos, influencer partnerships, and educational demos that link directly to sales(*K18 Hair (@k18hair) | TikTok*, n.d.). One case study notes K18's TikTok Hair Flip Challenge (#k18hairflip) drove an 11.2 billion-view campaign and a 70% lift in daily sales(Lorincz, 2023). "*Our #K18HairFlip challenge put K18 on the map in terms of brand awareness and virality <…> We didn't think we could live up to the hype, but #K18results exceeded our expectations*" – Michelle Miller, SVP of Global Marketing, K18 Hair(*How K18 Sparked A #HairTok Community Trend | TikTok Business Case*

Study, n.d.). By integrating social commerce, K18 effectively turned scientific storytelling into a direct sales engine.

Social commerce platforms used

K18's marketing leans on social networks, especially visual/video platforms and TikTok is their centerpiece. Instagram and Twitter are also part of their channels, K18 posts hair science tips, before/after videos, and Q&As to educate and build community (the official @k18hair account has hundreds of thousands of followers(*K18 Hair (@k18hair) • Instagram Photos and Videos*, n.d.)). The brand's marketing emphasizes stylists and influencers like Hailey Bieber, Brad Mondo, Mikayla Nogueira, Sofia Richie, Anna Sitar and TikTok hair experts to reach fashion-forward young auditory(Modash, 2025). These networks were chosen because K18's demographic is young, beauty and science curious consumers and they are highly active on them. The strategy is "education + emotion"(Goodwin, n.d.). Stylists and influencers demo the product on TikTok/Instagram, making the biotech story accessible.

Challenges in Commercialization

As a biotech beauty startup has faced two main market barriers. First challenge was translating complex science into consumer trust. The brand needed to explain a complex scientific innovation (peptide repair technology) in a fun, accessible way. Second challenge includes cutting through a highly competitive haircare market dominated by established brands. Educating consumers on a complex biotech product and sustaining long-term engagement on social media platforms that are rapidly evolving(Goodwin, n.d.; Lorincz, 2023; Pile, 2022). K18 Hair effectively overcame these challenges by capitalizing on TikTok and Instagram's strengths.

3.8 Case Study nr.: 7 – Bioklab

Bioklab is now a large company and no longer classified as a startup, but it was chosen for this research case study to provide a comparison with smaller companies and to include an overview example of a large company in the deep-tech beauty field.

Company Profile Description

The BIOK LAB officially known as BIOK Laboratorija, is founded by 5 scientists in biochemistry with a desire to innovate with natural ingredients for skin's healthy look. BIOK Laboratorija, was founded in 1988, in Kaunas and now count over 30 years of experience in the field of beauty cosmetics by creating and producing "*natural and organic products enriched with plant-based, herbal, bio-technological and synthetic active ingredients to provide healthy skin, hair and teeth"(BiokLAB, 2025)*. Biok lab products have been popular in Lithuania for several years, consistently ranking among the five most purchased products in the cosmetics category(Pauraitė, 2022). Its portfolio includes three main brands: Kilig (urban natural cosmetics), Margarita (family-oriented Baltic-inspired products), and Ecodenta (super-natural oral care). These products

emphasize plant-based, herbal, and biotech-derived active ingredients for healthy skin, hair, and teeth(BiokLAB, 2025).

Core technology or innovation type

BiokLab's innovation rooted in biotechnology and natural herbal science. The founders and scientists' crew are biochemists who combine plant-based and bio-technological actives in their formulas. They leverage expertise in biology, chemistry, dermatology, dentistry and cosmetics to create advanced products.(BiokLAB, 2025; Pauraitė, 2022). All products are developed through thorough scientific research and developing/testing (R&D). For example, recent innovations include whitening toothpastes enriched with natural extracts (Lithuanian amber and blueberry) and new probiotic skin-care lines, showing how they use unique bioactive ingredients(BiokLAB, 2025). Their uniqueness and innovation lies in nature-inspired, laboratory-proven solutions.

Target market and customers

Biok Lab mainly targets consumers and professionals in almost all Europe, but Lithuania remains the main market. The company targets health and ecology conscious consumers who prefer natural, science based beauty and oral care products. For distribution, BiokLab works with large retail chains and also offers private-label manufacturing (producing goods for other brands)(BiokLAB, 2025; Pauraitė, 2022).

Commercialization strategy

Bioklab brings its innovations to market through a multi-channel approach. BiokLab retail partners with major retailers to launch products. The Lithuanian chain "Maxima" has been BiokLab's largest partner. BiokLab actively participates in global beauty expos. In 2024 it exhibited at Cosmoprof (Italy), Beauty Düsseldorf (Germany), Natural & Organic (UK), and the IDEM oral-care fair in Singapore. These trade fairs help BiokLab showcase its innovations to distributors and buyers worldwide. Bioklab emphasizes unique formulas and design to stand out. It highlights sustainable packaging and high-tech ingredients. As example, new Ecodenta toothpaste features sustainable materials (plastic-free clay-based toothpastes) and its KILIG cosmetics line uses trendy actives like retinol and probiotics. This commitment to innovation and green practices helps attract both partners and end-users(BiokLAB, 2025; Pauraitė, 2022).

Social commerce platforms used

BiokLab maintains active Instagram and Facebook content creators(facebook.com, n.d.; instagram.com, n.d.). These visual platforms are ideal for showing product images, demos, and customer testimonials. Bioklab is often seen in various influencer advertisements, stories and reels, they share their experiences and recommendations A LinkedIn company profile is used for B2B outreach and networking with industry professionals, distributors, and investors(linkedin.com, n.d.). Their YouTube channel hosts longer videos (such as product demos or CSR stories) that engage customers and showcase R&D efforts(youtube.com, n.d.).

Challenges in Commercialization

Bioklab faces several barriers in bringing its innovations to market. One challenge is regulatory complexity. Cosmetics and beauty regulations (e.g. EU's Cosmetics Regulation) require strict testing and labeling. Another challenge is balancing natural ingredients with safety. While aiming for high natural content, Bioklab acknowledges that "*complete naturalness isn't always ideal*" – they must add synthetic preservatives or actives for product stability and UV protection(BiokLAB, 2025).

3.9 Conclusions of Case Studies Analysis

3.9.1 Conclusions of Case Studies

Case studies reveal a clear divide in social commerce strategies between consumers oriented deep-tech startups and those who target more professional markets. Consumer oriented companies like Pulsetto, Function of Beauty, Ōura, OneSkin, and K18 Hair all rely heavily on Instagram, TikTok and other visual platforms to drive and boost brand visibility, engagement. Pulsetto leverages Instagram, TikTok, LinkedIn, and YouTube with shoppable posts, live demos and user-generated content to showcase their actual benefits ("60% anxiety reduction" in testimonials). Function of Beauty and K18's similarly uses Instagram aesthetics and TikTok viral challenges (like #ShampooShakeUpChallenge and #k18hairflip). Function of Beauty goal is to highlight its customizable products and reach niche beauty audiences. K18's strategy is built around a TikTok-centric campaign featuring stylists and viral hair-care content. Ōura's marketing employs Instagram, TikTok and Snapchat (plus celebrity endorsements) to appeal to young, health-conscious users. OneSkin also use TikTok and Instagram intensively. OneSkin post educational videos and influencer content about skin longevity to attract "biohacking" aficionados. In these cases social platforms function as the primary channels for storytelling, reflecting the startups' focus on direct-to-consumer DTC models.

By contrast, Kriya Therapeutics (a clinical-stage gene therapy company) has minimal presence on consumer social media, instead focusing on LinkedIn and Twitter for formal updates and investor relations. Its case shows that a heavily B2B biotech venture can go without Instagram and TikTok and still pursue commercialization via professional networks. Bioklab, an established Lithuanian cosmetics company sits in between: they maintain active Instagram and Facebook posts for product images and influencer ads and even YouTube for longer demos, but also uses LinkedIn for B2B outreach. As a result, it could be claimed that B2C deep-tech startups rely on social commerce, whereas B2B and traditional firms rarely do, or use it only for special cases.

Influencer marketing and viral campaigns emerged as a common pattern among the consumer oriented cases. For instance Pulsetto partnered with well-known biohackers and athletes (including NBA stars) to boost credibility and their brand. Function of Beauty collaborated with niche beauty influencers to foster authentic community engagement. K18 Hair's experience shows that its TikTok "#K18HairFlip" challenge generated billions of views and was associated with increased sales. Ōura and OneSkin also leverage high-profile advocates and trending topics. Ōura frequently shares user-

generated content and polished ads featuring celebrities on Instagram and TikTok, which amplifies trust in their wellness ring. OneSkin has gained notice through associations with longevity advocates such as Dr. David Sinclair and promotes its science via TikTok demos and Pinterest infographics. **These examples show that social media campaigns – whether through stylized challenges, celebrity stories, or micro/macro influencers – significantly enhanced brand visibility and engagement for these startups (H4 confirmed).**

Social platforms also played a key role in building user trust and educating customers about complex products. After case studies one of the findings is that several startups explicitly use social content and platforms to explain their science behind their technology. OneSkin posts TikTok explainers and infographics to illustrate how its patented peptide reverses cellular aging. Pulsetto's Instagram reels similarly use data-driven testimonials to demonstrate device efficacy and reassure consumers. K18 Hair adopts an "education+emotion" strategy when stylists and influencers create science-backed videos that make its molecular hair repair technology understandable to all users. Even Function of Beauty, which is less technical, leverages its data-driven personalization narrative and community reviews to build credibility among customers seeking bespoke products. **In all cases, social media became a channel for storytelling and trust-building (H3 confirmed). By pairing user testimonials and expert endorsements with accessible content these startups overcame communication gap inherent in deep-tech (H6 confirmed).** This directly addresses a major commercialization barrier (consumer skepticism toward complex innovations) by making technology feel transparent and relatable.

Overall, a clear pattern emerges – startups targeting end consumers in health and beauty have found social commerce strategies highly effective for market entry and growth, while those focused on institutional or professional audiences rely less on such tactics. The cases show that creative use of social media platforms especially visually-driven ones like TikTok and Instagram, can overcome traditional commercialization barriers for deep-tech health and beauty startups. Comparing effectiveness, the consumer oriented *social commerce model* proved particularly potent and generated rapid visibility, authentic engagement and trust for products that might otherwise struggle in traditional channels.

3.9.2 Significance for the next stage of empirical research

Results of case study analysis helped in shaping the design of the survey questionnaire. By examining how deep-tech startups use social commerce platforms in practice, the case studies helped identify the most relevant features to be tested quantitatively. Together with literature review main features are claimed – influencer involvement, educational content, visual storytelling, and platform-based engagement tools. These recurring patterns were translated into concrete survey questions measuring consumer perceptions of innovativeness, trust, engagement, perceived complexity, and purchase intention. As a result, questionnaire were directly grounded in real-world

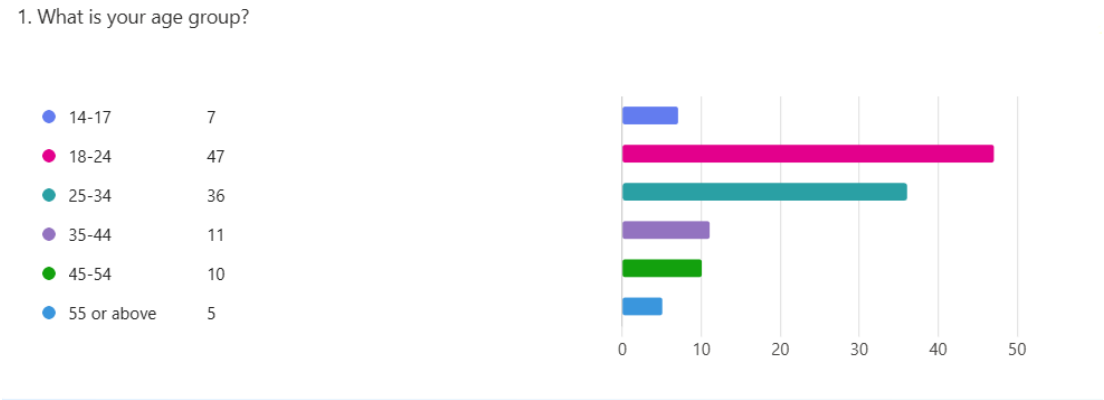
commercialization strategies observed in the case studies, ensuring consistency between the components of the research.

3.10 Survey results

3.10.1 Respondent Profile

This section provide an overview of the sample (age, gender, education, spending). This sets context and describe who answered the survey. This study was conducted from November 13 to December 2, 2025, with 116 respondents participating, all of whom were eligible for further analysis. According to the research methodology, an average of 100-120 respondents were required to achieve a meaningful study.

Figure 5 Age Distribution Chart



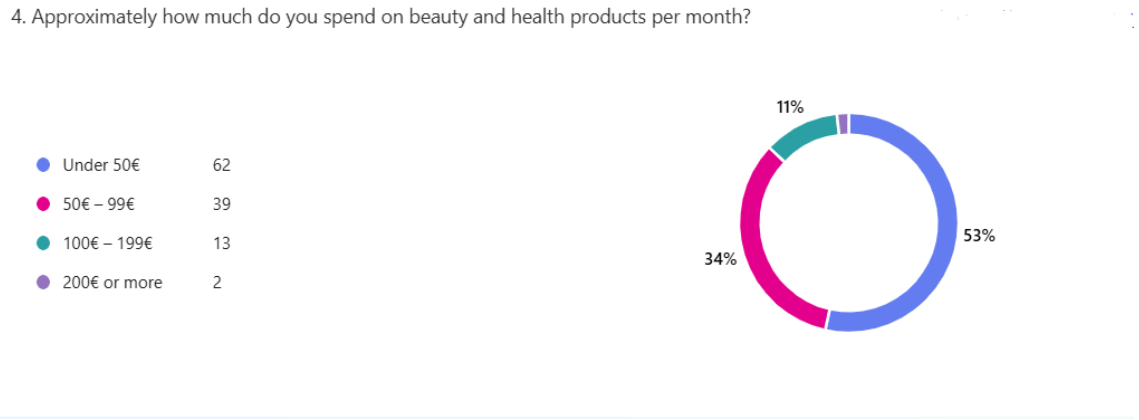
The survey respondents were educated – 74% have a bachelor's degree or higher, and young 78% are between 14-34 years. The largest age group was 18–24 (40.5%), followed by 25–34 (31.0%); only a minority were over 45 (9% combined for 45+) (Figure 5).

A slight majority 59% identified as women, 41% as men, and <1% preferred not to say (Figure 6). The goal was to reach as many men as possible and to minimize the difference between the number of responses from men and women. It can be claimed that the goal has almost been achieved because the difference in quantity is not very large.

Figure 6 Gender Distribution Chart

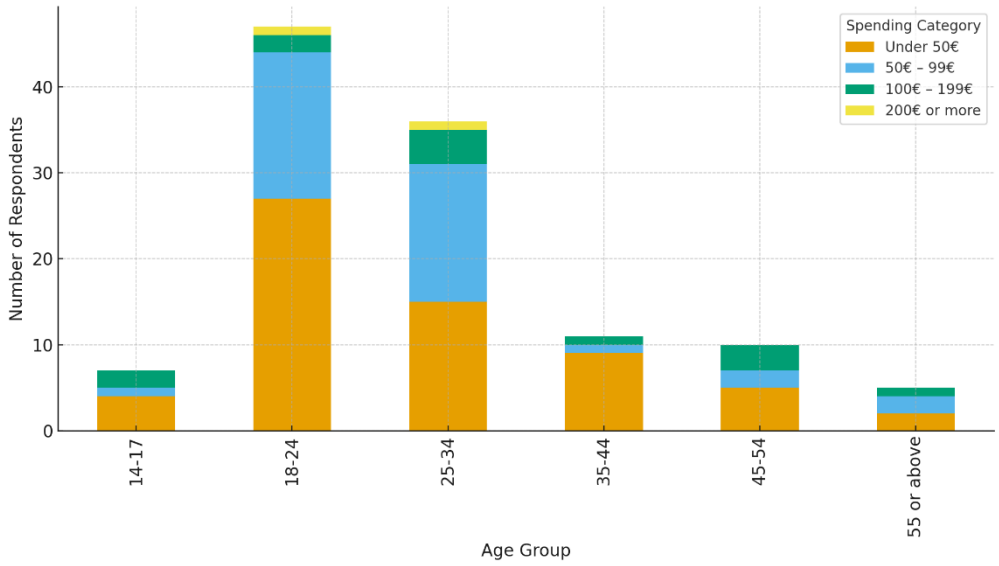
Most participants held a university degree (≈72% had a bachelor's or higher), with only 17% having high school or less. Monthly spending on beauty/health products tended to be modest: 53% spend under €50, 34% spend €50–99, and only 13% spend €100 or more (Figure 7).

Figure 7 Monthly Spending Chart



The analysis showed that customers aged 18–24 and 25–34 are the largest groups, with spending primarily concentrated in the under €50 and €50–99 categories. Older age customers groups 35–54 and 55+ have fewer score overall but display a relatively higher share of spending in the €100–199 and €200 or more categories, indicating greater purchasing power despite lower participation (Figure 8).

Figure 8 Spending Categories by Age Group

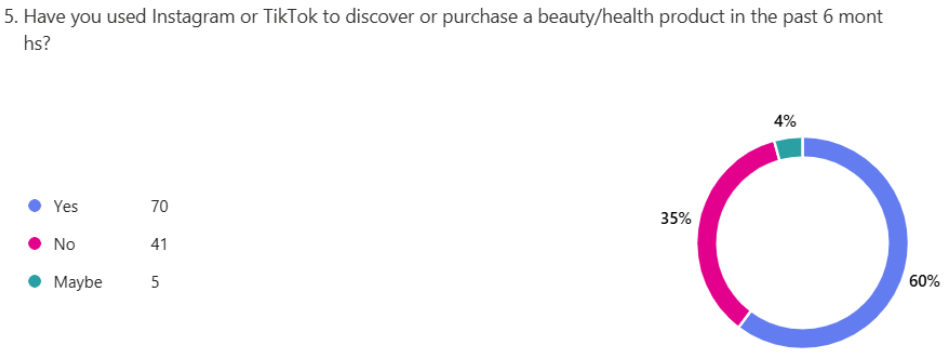


According to these demographics, mainly participated young, educated social platform users with modest beauty and health product budgets.

3.10.2 Social Commerce Platform Usage

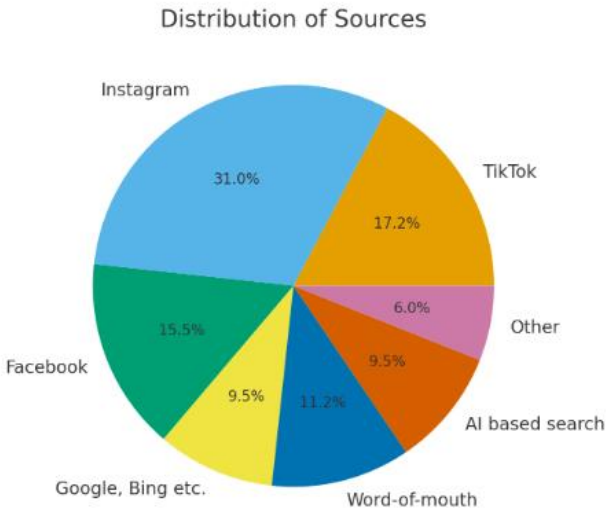
This section analyze what and how respondents use social media for beauty/health shopping and discovering. Most respondents 60% reported using Instagram or TikTok to discover or purchase beauty/health products in the past six months, with only 35% saying no (Figure 9).

Figure 9 Whether respondents have used Instagram or TikTok to discover or purchase a beauty or health product in the past 6 months



Instagram was the single most common source for learning about new products (31% of respondents), followed by TikTok (17,2%) and Facebook (15,5%) (Figure 10).

Figure 10 Source respondents use most to learn about innovative beauty and health products



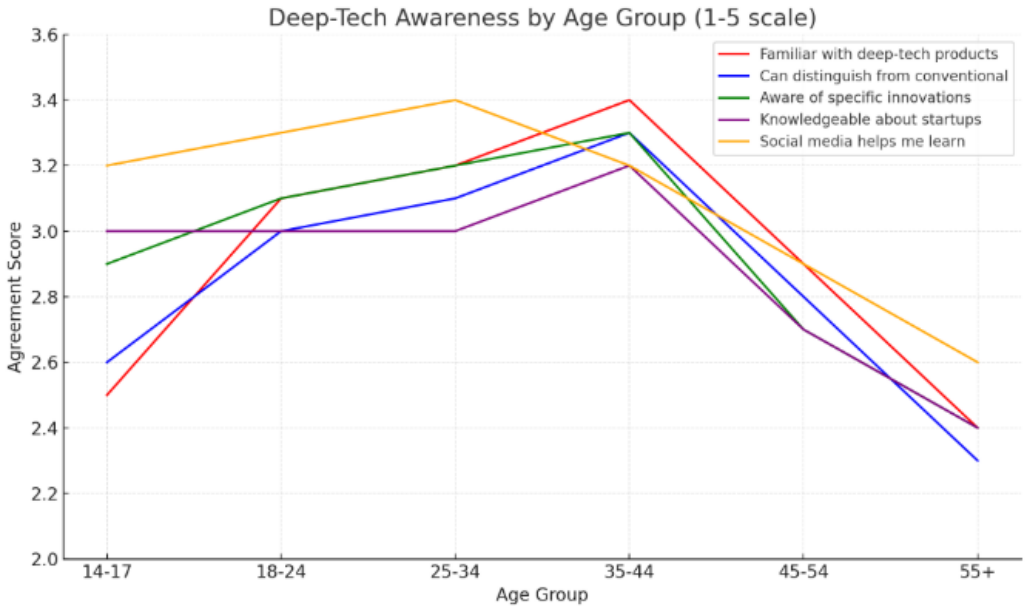
Other sources included word-of-mouth (11,2%) and search engines (combined ≈20%). Younger respondents were especially active because about 68% of 18–24 year-olds had used Instagram/TikTok for discovery, compared to ≈57% of those 25–34. Direct commerce via these apps was less common – only 27.6% had ever bought a beauty/health item through Instagram Shop or TikTok Shop. These patterns reflect how young consumers increasingly integrate social media into their shopping, using mainly Instagram and TikTok for discovering new products, consistent with

studies that emphasize social platforms' role in generating buyer interest and trust. Also results show that social media content plays a significant role in shaping consumer decisions to try or purchase new beauty and health products, with 46.6% agreeing and additional 6% strongly agreeing. **They indicated that recommendations, reviews, and influencer content on social platforms meaningfully impact their buying behavior.**

3.10.3 Deep-Tech Awareness and Perception

In this section respondents showed moderate awareness of deep-tech in beauty and health. 53% of respondents agreed or strongly agreed that they were familiar with science driven products and innovations and could distinguish them from conventional products. A similar share 52% said they were aware of AI/biotech used in these products, and even 50% felt knowledgeable about deep-tech startups. Notably, 59% agreed that social media helps them learn about innovative tech products. The surprising fact according to the results, is that respondents feel knowledgeable about deep-tech startups as they do about recognizing AI or biotech-driven products. It can be stated that exposure through social media may be giving people a sense of familiarity with advanced technology even if they don't fully understand the science behind it.

Figure 11 Deep-Tech Awareness by Age Group (1-5 scale) (the agreement score represents the average level of agreement for each age group on a 1–5 scale)



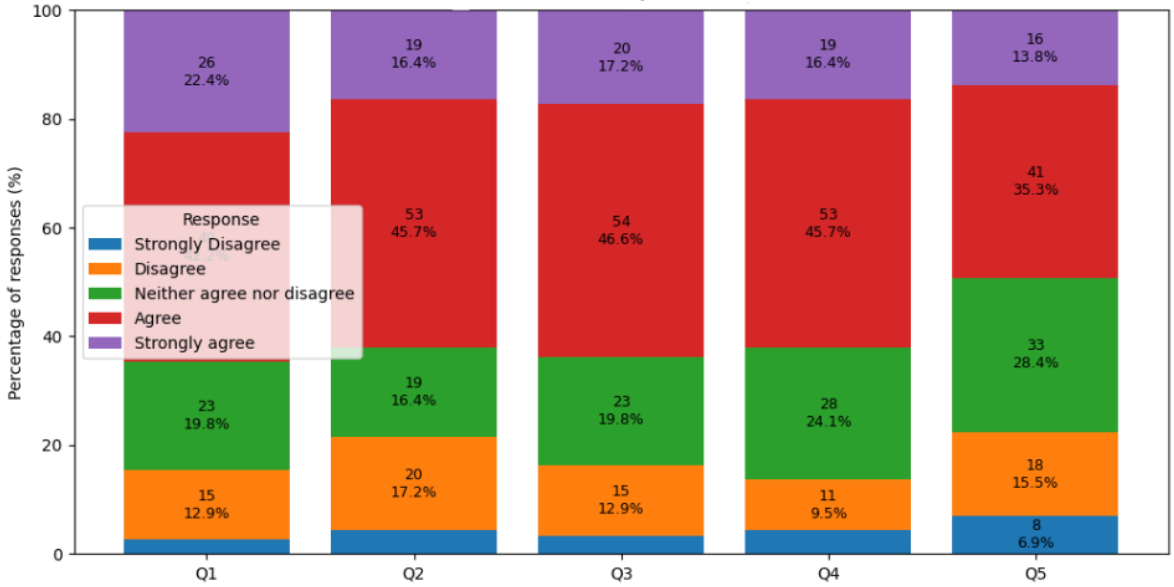
Deep-tech awareness tends to peak between ages 25–44 across all statements, suggesting that younger and mid-career adults are the most engaged and informed about technology-driven beauty and health innovations. Awareness consistently declines after age 45, indicating that older audiences are less familiar with deep-tech concepts and rely less on social media to learn about them (Figure 11).

When asked to define a deep-tech beauty and health product, 38% said it sounded like an improved version of existing products, whereas 29% regarded the term as mostly marketing, and

27% saw it as cutting-edge science. Only 7% were unsure. Thus, many consumers see deep-tech as simply an upgrade, with a substantial minority viewing it skeptically as hype.

Majorities recognized examples of deep-tech, even 64,6% agreed (22,4% strongly) that devices like smart rings or personalized health apps exemplify advanced deep-tech products. Over 62,1% (including 45,7% "agree" and 16,4% "strongly agree") said learning that product uses advanced science makes them more interested in trying (Figure 12).

Figure 12 Familiarity and Interest in Deep-Tech Products Chart



Q1. Products such as smart rings (e.g., Ōura) or personalized skincare solutions (e.g., Function of Beauty) appear more innovative than typical beauty and health products, such as standard moisturizers, shampoos, or fitness trackers.

Q2. When I learn that a beauty or health product is developed using advanced science or technology, I become more interested in trying it.

Q3. I consider deep-tech startups in the beauty and health sector to be more innovative than established brands.

Q4. I find the idea of trying high-tech beauty or health products developed by new startups appealing.

Q5. Some high-tech beauty or health products I encounter online seem too complex or unrealistic for me.

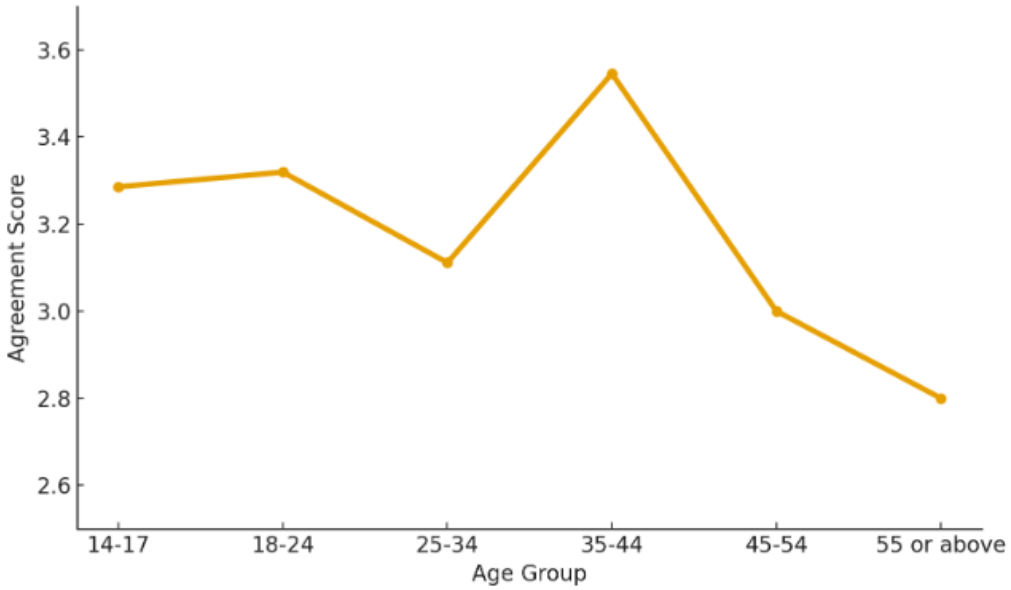
These findings indicate that mentioning and usage of advanced science often increases customers' interest and deep-tech concept appears appealing. On the other hand, a notable minority remains neutral. Surprisingly 13,8% simultaneously feels that some of these products seem too complex or unrealistic. Overall, respondents' perceptions suggest moderate enthusiasm for deep-tech innovations, aligning with the statement that **social commerce can make it easier to understand complex products and build interest in novel technologies(H1 confirmed).**

3.10.4 Social Media Influence and User Engagement

In this section is analyzed how social media content, formats and influencers influence respondents. Results shows that social media had a clear influence on users' attitudes and content preferences. Over half – 56% agreed and 20% said maybe that social media content strongly influences their decisions to try or buy innovative beauty/health products if they see a trusted influencer using or recommending it. 42% of respondents would trust a new product if it is recommended by a trusted influencer, while an additional 25% indicated they might trust it, suggesting that **influencer storytelling can meaningfully shape consumer trust and social media platforms serve as effective storytelling channels through which deep-tech startups can communicate (H3 confirmed).**

After the statement "*I am more likely to believe claims about a product after watching an influencer use it in a video, story, or reels*" only 29.9% of respondents disagreed, and the analysis shows that this group is mainly older users who also tend to spend less on beauty and health products (Figure 13).

Figure 13 "I am more likely to believe claims about a product after watching an influencer use it in a video, story, or reels"



This is consistent with research showing that influencer explanations build trust and trial intention. About 37,9% of respondents admitted that they follow at least one deep-tech beauty or health startup on social media. **It shows that content about deep-tech innovations is appealing and captures users' attention motivating them to follow the updates of these brands and creators(H5 confirmed)**. And even 28,4% have purchased a product from a deep-tech beauty/health startup in the past. Of those who made a deep-tech purchase, Instagram, Facebook and TikTok were the top discovery sources (11, 8 and 7 mentions, respectively) (Table 3).

Table 3 Who made a deep-tech purchase?

Platform	Count
Instagram	11
Facebook	8
TikTok	7
Word-of-mouth	3
AI based search	2
Other	1
Google, Bing etc.	1

A clear majority – 67% of respondents agree or strongly agree that deep-tech product videos, reels, stories hold their attention, **showing that short-form visual content is a powerful engagement format for these types of innovations (H4 confirmed)**. The biggest part of them almost 78% rely on Instagram, Facebook and TikTok platforms.

Figure 14 Interactions

Although deep-tech beauty content clearly reaches people, most users remain quiet observers rather than active participants. They prefer scrolling past far more often than interacting, liking, sharing or commenting (Figure 14).

3.10.5 Confidence and Trust in Deep-Tech via Social Commerce

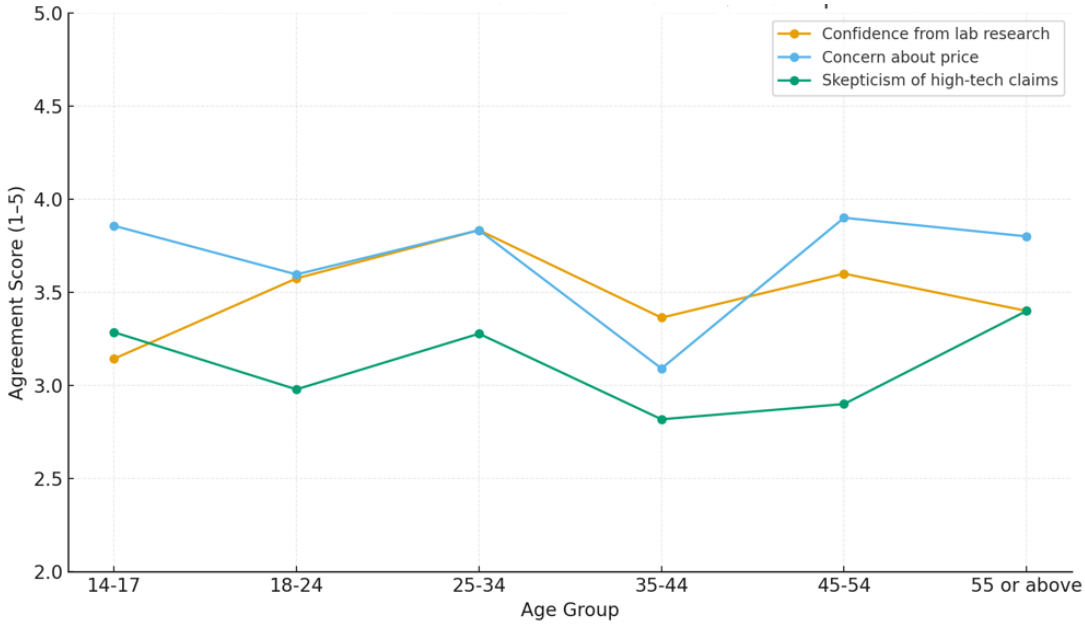
There is results of respondents' trust in social commerce shopping and their skepticism or concerns. Trust in deep-tech products and in social commerce features was modest. Only about 50% respondents agreed that they trust the quality and safety of products from deep-tech startups, and a similar share believed that new high-tech devices advertised on Instagram/TikTok would work as claimed. In contrast, 41,4% expressed skepticism toward claims made by new deep-tech driven products. Trust in influencer endorsements about deep-tech products was moderate: 62,9% agreed that they trust recommendations from social media influencers endorsing deep-tech products, while roughly 29,3% disagreed. These mixed responses highlight a trust gap – not everyone tends to

believe their claims and require reassurance about safety and efficacy before embracing novel products.

Confidence in social commerce shopping tools was even lower. Only 43,9 % felt confident buying new or innovative products through social media, and just 36.2% said they trust the shopping features (tags, in-app checkout) on Instagram/TikTok for purchasing beauty/health items. **This data shows that social commerce is excellent at visibility(H3 confirmed)** but not at conversion, people discover deep-tech brands on social platforms, yet most still prefer to complete their purchases on official websites, reflecting limited trust in in-app shopping tools. This contrasts sharply with markets for example in the U.S. or China where a significant share of beauty and tech product sales happens directly within platforms such as Instagram, TikTok.

Nearly 68.9% agreed that seeing lab-based or clinical research mentioned in social posts increases their confidence in a product's effectiveness. This says that transparency with proofs (clinical data, results of experiments, reviews) can mitigate skepticism, fear to try. **These results underscore that while social platform content can build interest, building trust on product or services – especially via credible research and influencer testimonials – is crucial for deep-tech products (H6 confirmed).**

Figure 15 Trust and Confidence Indicators by age groups

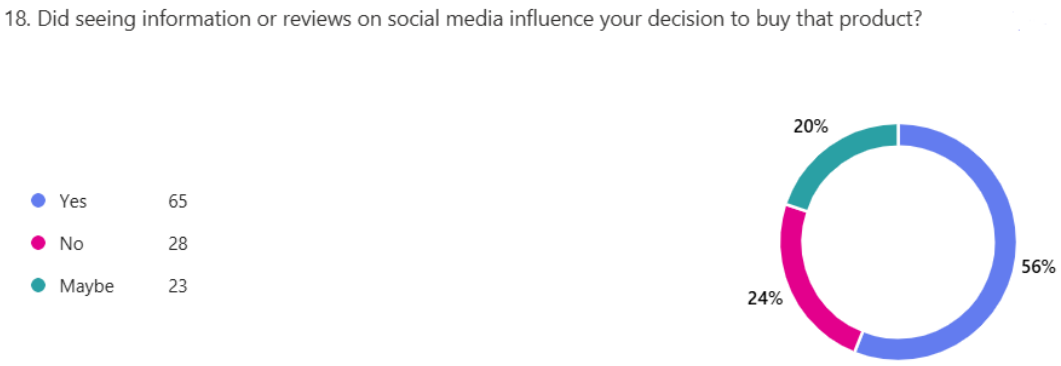


Looking at this data from different perspective interesting insights appear – the youngest (14-17) and oldest (55+) age groups show the highest concern about price, while middle-aged groups (35-44) display notably lower price concern and confidence in lab research. Skepticism of deep-tech claims increases with age, rising from around 3.0 in younger groups to 3.4 in those 55+(Figure 15). It could be declared that older consumers are more cautious about technological marketing claims.

3.10.6 Deep-Tech Purchase Behavior

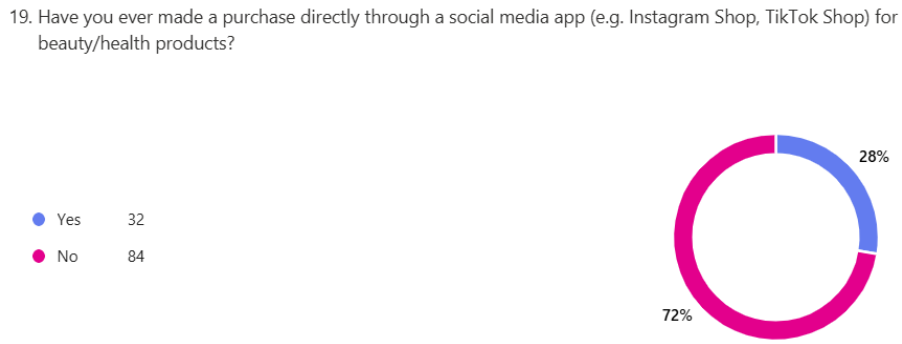
This section report how many respondents have actually bought deep-tech beauty/health products and how social media influenced those purchases. Actual and intended purchase behaviors reveal a cautious but growing market for deep-tech products. 46% of respondents reported they have ever purchased a deep-tech (science-based or high-tech) beauty or health products or device. Over half (56%) of purchasers said social media content influenced their buying decision, reinforcing that peer reviews and influencer content can trigger action (Figure 16).

Figure 16 Social Media Influence on Purchase Decisions



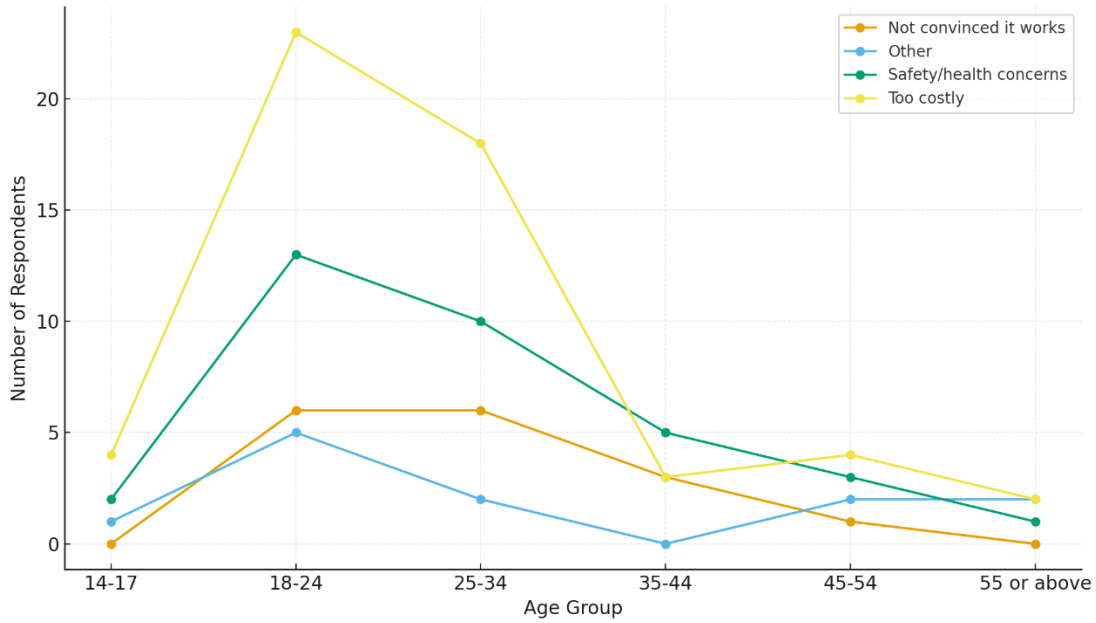
However, only 28% had ever completed a purchase directly through a social media app, suggesting that many still use social channels primarily for discovery rather than checkout (Figure 17).

Figure 17 Completed a purchase directly through a social media app



Looking forward, intention to buy is higher than past action, 49,1% agreed that they intend to purchase a deep-tech beauty/health product in the near future (with another 29,3 % neutral). **This potential reflects the combination of interest and ongoing trust-building, nearly half of all users want to try advanced products (H6 confirmed)**. The main barriers reported was cost and safety(Figure 18). When choosing concerns that might stop them, 31% mentioned "*too costly*" and 27% "*safety/health concerns*", while 26% mentioned that they are "*not convinced it works*".

Figure 18 Which concern is most likely to stop you from buying a deep-tech beauty/health product?



Cost dominates as the barrier for ages 18-34, while safety concerns are highest among young adults and decline with age. This aligns with literature review insights noting cost and trust as key adoption hurdles. In sum, the survey results suggests that social commerce is already a significant influence on deep-tech product adoption, but widespread purchase will require addressing cost and trust issues.

3.10.7 How Social Commerce Usage Influences Starup's Visibility

The results of the case studies show how start-ups use social media and below they are ranked accordingly in the table (Table 4).

Table 4 Social Commerce Intensity

Rank	Company	Level of Social Commerce Use	Key Reasons
1	K18 Hair	Very high	Viral TikTok campaign, heavy influencer use, huge engagement & sales impact.
2	Pulsetto	Very high	Shoppable posts, testimonials, influencers (biohackers/athletes).
3	Function of Beauty	High	TikTok challenges, strong Instagram aesthetic, niche communities.
4	Ōura	High	Celebrity endorsements, multi-platform lifestyle marketing.
5	OneSkin	Moderate–High	Science explainers, longevity influencers, educational content.

6	Bioklab	Moderate–Low	Mostly product visuals, some influencers; B2B presence on LinkedIn.
7	Kriya Therapeutics	Very Low	Strictly professional platforms, no consumer social commerce.

The table ranks the start-ups by their level of social commerce use showing that consumer oriented brands like K18 Hair and Pulsetto rely heavily on TikTok, influencers, and visually driven platforms to generate visibility and engagement. In comparison companies such as Bioklab and especially Kriya Therapeutics use social media far less extensively, reflecting their more traditional or B2B-focused communication strategies. Below are the survey results showing which start-up respondents had heard of the most(Table 5).

Table 5 Ranked Popularity Table

Rank	Company	Count
1	Pulsetto	44
2	K18 Hair	34
3	Ōura	31
4	Bioklab	29
5	None of the above	26
6	Kriya Therapeutics	16
7	OneSkin	14
8	Function of Beauty	11

The survey results show that Pulsetto, K18 Hair, and Ōura were the most widely recognized start-ups among respondents of the survey. Function of Beauty and OneSkin were the least familiar for respondents. **The comparative analysis of case studies and survey outcomes demonstrates a relationship between the intensity of social commerce usage and public visibility of deep-tech startups (H4 confirmed).** Startups that engage most actively with visually driven platforms especially TikTok, Facebook and Instagram tend to achieve higher recognition, as reflected in the survey. For example, K18 Hair, ranked first in social commerce usage due to its viral TikTok campaigns and influencer partnerships, they appears among the most recognized brands in the survey (34 responses). Similarly, Pulsetto which employs a very high level of social commerce activity through athletes partnerships, biohacker endorsements, and data-driven testimonials, received the highest familiarity score (44 responses). **These results indicate that sustained, creative, and platform-native social commerce strategies significantly elevate market visibility even for early-stage and niche deep-tech innovative products (H2 confirmed).**

Interestingly, Function of Beauty and OneSkin, both actively use social commerce, but received lower recognition scores, suggesting that visibility outcomes depend not only on activity level but also on virality, message clarity, and campaign resonance. It is also important to note that these brands are primarily popular in the US, Japan, and Canada, and the survey was conducted in Lithuania, that why results may not fully reflect their actual visibility around the world. At the opposite end, Kriya Therapeutics, which deliberately avoids consumer oriented channels and relies on professional networks, predictably scored low (16 responses), reinforcing the idea that B2B biotech firms do not benefit from social commerce in the same way as consumer orientated startups.

Bioklab offers a useful contrast. Despite its moderate–low social commerce usage, it ranked relatively high in recognition (29 responses). This reflects its status as an established cosmetics brand and their visibility stems from longstanding market presence. This case highlights that while established firms can rely on brand heritage new deep-tech startups cannot. It is recommendation for start-ups to actively build awareness, trust, and storytelling through social platforms to overcome market barriers and technical complexity.

3.11 Strategic framework and recommendations

Based on the research findings strategic framework is proposed to guide deep-tech startups in the health and beauty sector in effectively leveraging social commerce for market entry and growth. The framework integrates trust-building, consumer education, and platform-native engagement as core strategic pillars (Table 6).

Table 6 Strategic framework

Action	Strategic action	Empirical grounding	Key tools
Translate complex technology into consumers values (addressing perceived complexity & low trust)	Deep-tech startups should simplify scientific and technological messaging by translating complex innovations into clear consumer benefits (visible results, personalization, health outcomes).	Survey result indicate that consumers show higher interest and trust when advanced technology is explained in an simple way, while excessive complexity reduces appeal.	• Educational short-form content (videos, reels); • Before–after demonstrations; • Plain-language explanations of technology benefits.

Leverage influencers (reducing trust barriers through social proof)	Influencers should be used not only as promoters but as credibility bridges between deep-tech innovation and consumers.	Case studies showed that influencer-led communication increased visibility and trust, while survey findings confirmed higher trust and purchase consideration when products are introduced through relatable voices and faces.	• Long-term influencer partnerships; • Authentic product trials and testimonials; • Influencer and product content fit; • Influencers with perceived expertise or lived experience.
Use platform native social commerce features (maximizing algorithmic reach and engagement)	Startups should adapt content to platform-specific formats and algorithms rather than treating social media as traditional advertising channel.	Findings formats that engagement and visibility are higher when content aligns with platform logic (TikTok short videos, Instagram Stories, interactive formats).	• Short-form video formats; • Interactive features (polls, Q&A, live sessions, giveaways); • Algorithm optimized posting strategies.
Build trust before driving sales (sequential commercialization logic)	Deep-tech startups should prioritize trust and education before active sales messaging.	Survey results indicate that trust and perceived credibility are prerequisites for purchase intention, especially for health and beauty products which involve personal risk.	• Educational campaigns before product launches; • Transparency about testing, data, and safety.
Continuously validate strategies through consumer feedback	Social commerce should be treated as a feedback loop rather	Quantitative findings highlights differences in	• Follow engagement metrics (likes,

(data-driven adaptation)	than one direction communication channel.	engagement and perception across consumer groups, emphasizing the need for continuous monitoring.	comments, saves, shares); • Consumer surveys and polls; • Iterative content testing.

This framework demonstrates that social commerce functions not merely as a promotional channel but as a strategic commercialization direction for deep-tech startups.

Here are practical and research-based recommendations for deep-tech startups in the health and beauty sectors that want to use social media for commercialization:

1. Develop clear, relatable content and break down complex science or technical features into simple demonstrations and stories;
2. Engage with influencers and community. Pay attention to influencer's statistics – an average engagement value, follower count, audience demographics, aggregate reach, type of content shared and etc. Partner with influencers or experts relevant to the startup's field. Influencers provide authentic reach and social proof if they are selected correctly;
3. Create aesthetic and eye-catching design because customers especially in beauty and health sector appreciate and pay attention to view, style and aesthetics;
4. Motivate customers to share their experiences using start-up products and encourage user-generated content. This can be done through giveaways, campaigns or by featuring customer stories;
5. Engage consistently with your audience. By organizing viral challenges, participating in trends or showing behind-the-scenes content;
6. Invest in customers support and transparency. Maintain high service quality, answer questions, offer clear information, and have fair return policies;
7. Use data to refine strategy by tracking social media analytics (such as TikTok pixel or Instagram insights) to learn which content engage most;
8. Start small and scale gradually. Begin with one or two platforms and refine your approach before expanding. Focus on creating high-quality content rather than trying to be everywhere at once.

4 CONCLUSIONS AND RECOMMENDATIONS

Social commerce offers a powerful strategic solution for deep-tech health and beauty startups to overcome traditional market barriers.

1. This research identified a clear set of marketing and commercialization challenges faced by deep-tech startups in the health and beauty sectors. First, complexity of scientific innovations makes it difficult for startups to explain product benefits in a way that is understandable to non-technical consumers. Second, long development cycles and high R&D costs create funding constraints and delay market entry, increasing investor risk and limiting marketing resources. Third, low initial consumer trust presents a major barrier, as health and beauty products are perceived as high-risk and require strong credibility before purchase. Fourth, many deep-tech founders lack marketing and communication expertise and face difficulties translating scientific language into consumer understandable messages and hinders effective brand positioning and consumer engagement. Fifth, regulatory and certification requirements slow commercialization and complicated messaging, particularly in health related products, where safety and efficacy must be proven before market entry. Moreover, managing intellectual property and adapting to various cultural expectations further increase the burden on startups. Finally, intense competition from established brands makes it difficult for startups to achieve visibility and differentiate themselves in the market.

2. This research identified specific social commerce platform features that directly address the key commercialization challenges faced by deep-tech startups in the health and beauty sectors. First, short-form videos, reels, live demonstrations, content sharing, and educational posts help overcome the challenge of technological complexity by translating scientific innovation into simple, visually understandable messages for customers. Second, influencer partnerships, demonstrations and endorsements, and user-generated content address the problem of low consumer trust by providing social proofs and credible third-party validations. Third, algorithm-driven content distribution and repeated exposure within users' feed increase brand visibility, helping startups compete with established brands despite limited marketing budgets. Fourth, peer interaction features, such as comments, reviews, and community engagement, reduce consumer uncertainty by allowing shared experiences and feedback. Finally, platform-based shopping tools, including shoppable links and in-app purchasing, support market entry and conversion by reducing friction between product discovery and purchase.

3. The analysis of real-world examples in the work demonstrates that several deep-tech startups in the health and beauty sectors have successfully used social commerce to overcome market entry challenges and build connection with consumers. Startups like Pulsetto, Function of Beauty, Ōura, and K18 Hair have effectively engaged with platforms such as TikTok and Instagram by creating relatable, educational, interactive content that simplified their scientific innovations. These companies leveraged influencer partnerships, short-form videos, and user-generated content

to build trust, explain product benefits, and boost engagement. Insights from the public survey supports these findings showing that consumers more likely to trust and purchase deep-tech products when they are presented through familiar and engaging formats on social media. Together, the case studies and survey responses confirm that social commerce provides a valuable environment for deep-tech startups to gain visibility, educate users, and scale their commercialization efforts.

4. The survey results confirm that specific social platform features directly influence consumer engagement, trust-building, and brand visibility for deep-tech health and beauty products. Interactive and visual features, such as short-form videos, product demonstrations, and influencer content, were associated with higher levels of consumer engagement, as respondents reported greater interest and attention when products appeared repeatedly in their social media feeds. Trust-building was strongly influenced by influencer reviews, user-generated content, and demonstrations, with a substantial share of respondents indicating increased trust and a higher likelihood of purchase after exposure to such content. For brand visibility, algorithm driven content distribution and repeated exposure significantly increased product awareness, allowing deep-tech startups to remain visible despite limited marketing resources. These findings demonstrate that social commerce platform features not only support promotion but also actively shape consumer engagement, trust formation, and visibility, confirming their strategic importance.

5. The strategic framework has been developed based on the findings of the case studies and survey, addressing the gap between innovative deep-tech products and their communication to consumers including trust building, understanding, education, and platform-native engagement.

6. In conclusion, this work has significantly contributed to the understanding of social platform factors that influence the growth, market entry and commercialization of deep-tech startups. The results provide actionable insights for startups to improve customer acquisition and customer engagement, ultimately contributing to a more efficient and easier integration of startups into the market.

Recommendations

Future research could expand this research by examining social commerce strategies across different deep-tech sectors and geographic markets, as well as by applying longitudinal or experimental designs to assess long-term effects on trust and purchase behavior.

From a practical perspective deep-tech startups should view social commerce as strategic tool for education and trust-building rather than solely as a sales channels. Practitioners are advised to align platform features with specific commercialization challenges, prioritize credible influencer partnerships and use data-driven feedback to continuously adapt communication strategies.

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6 ANNEXES

6.1 Survey - Deep-Tech Startups in Beauty and Health: Social Commerce Influence

1. What is your age group?

a) Under 18;
b) 18–24;
c) 25–34;
d) 35–44;
e) 45–54;
f) 55 or above

2. What is your gender?

a) Male;
b) Female;

3. What is the highest level of education you have completed?

a) High school or less;
b) Some college (or associate degree);
c) Bachelor's degree;
d) Master's degree;
e) Doctorate or higher.

4. Approximately how much do you spend on beauty and health products per month?

a) Under $50
b) $50–$99
c) $100–$199
d) $200 or more

5. Have you used Instagram or TikTok to discover or purchase a beauty/health product in the past 6 months?

a) Yes
b) No
c) Maybe

6. Awareness of Deep-Tech Products

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I am familiar with beauty or health products that use advanced science or technology (often called "deep-tech" products).					
I can distinguish deep-tech beauty/health products from conventional ones.					
I am aware of deep-tech innovations (e.g., AI-driven skincare, biotech supplements) being used in beauty or health products.					
I consider myself knowledgeable about deep-tech startups in the beauty/health industry.					
Social media (e.g. Instagram, TikTok) helps me learn about innovative, tech-driven beauty/health products or startups.					

7. How familiar are you with beauty and health brands that use biotechnology or advanced science (e.g., gene therapy, microbiome diagnostics, peptide-based treatments)?

a) Not at all familiar
b) Slightly familiar
c) Moderately familiar

d) Very familiar
e) Extremely familiar

8. Which source do you use most to learn about innovative beauty/health products?

a) Instagram?
b) TikTok
c) Facebook
d) Google, Bing etc.
e) Word-of-mouth
f) AI based search
g) Other

9. How would you describe a "deep-tech" beauty/health product when you first hear about it?

a) A cutting-edge scientific innovation;
b) An improved version of existing products;
c) Mostly a marketing term;
d) Unsure

10. Perceived Innovativeness

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Products like smart rings (e.g., Ōura) or personalized skin care (e.g., Function of Beauty) seem more innovative than typical beauty/health products (e.g. Nivea moisturizer or shampoo, basic fitness tracker)					
When I learn that a beauty or health product is developed using advanced science/technology, I become more interested in trying it.					
I think deep-tech startups in the beauty/health sector are more innovative than established brands.					
I find the idea of trying high-tech beauty or health products from new startups appealing.					
Some high-tech beauty/health products I see online seem too complex or unrealistic for me.					

11. Would you be more likely to trust a new product if you see a trusted influencer using or recommending it?

a) Yes
b) No
c) Maybe

12. Trust in Deep-Tech via Social Commerce

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I trust recommendations from social media influencers or peers when they endorse deep-tech beauty/health products.					

I believe a new high-tech beauty or health device advertised on Instagram/TikTok is likely to work as claimed.					
I trust the quality and safety of products from deep-tech beauty/health startups.					
I am skeptical of the claims made by new tech-driven beauty/health startups.					

13. Consumer Engagement with Social Content

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I follow at least one deep-tech beauty or health startup on social media.					
I have purchased a product from a deep-tech beauty/health startup in the past.					
I intend to purchase a product from a deep-tech beauty/health startup in the future.					
I would recommend a deep-tech beauty/health product to friends or family if I found it effective.					
Watching product videos (e.g. on TikTok or Instagram) about deep-tech beauty/health products holds my attention.					

14. How often do you interact with social media posts (like, comment, share) about new deep-tech beauty/health products?

a) Never,
b) Rarely
c) Sometimes
d) Often
e) Very often

15. Purchase Intention

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I intend to buy a deep-tech beauty/health device if an influencer I follow recommends it on social media.					
When I watch a product review video for an advanced beauty/health gadget, I am more inclined to buy that product.					

16. Have you ever purchased a deep-tech (science-based or high-tech) beauty or health product?

a) Yes
b) No

17. If yes, where did you first hear about the product before buying it?

a) Instagram
b) TikTok
c) Facebook
d) YouTube
e) Magazines/blogs

f) Store/Website
g) Friend/Family
h) Other

18. Did seeing information or reviews on social media influence your decision to buy that product?

a) Yes
b) No
c) Maybe

19. Have you ever made a purchase directly through a social media app (e.g. Instagram Shop, TikTok Shop) for beauty/health products?

a) Yes
b) No

20. Platform Habits & Content Type Influence

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Social media content has a strong influence on my decisions to try or buy new beauty/health products.					
I am more likely to believe claims about a product after watching an influencer use it in a video, story or reels.					
I prefer reading about technical features in text form.					

21. Do you prefer learning about new products through video (e.g. Reels, TikToks) rather than reading text/image posts?

a) Yes
b) No
c) Maybe

22. Consumer Attitude toward Social Commerce

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
I feel confident buying new or innovative products through social media.					
I trust shopping features on Instagram/TikTok (e.g. product tags, in-app checkout) for buying beauty/health items.					

23. Barriers to Adoption

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
Seeing lab-based or clinical research mentioned in social media posts increases my confidence in the product's effectiveness.					
I am concerned that deep-tech beauty/health products might be too expensive.					
I feel skeptical about the claims made for new high-tech beauty/health products on social media.					

24. Which concern is most likely to stop you from buying a deep-tech beauty/health product?

a) Too costly
b) Safety/health concerns
c) Not convinced it works
d) Prefer familiar brands

25. Have you ever come across any of the following deep-tech startups or similar brands on social media?

a) Pulseto
b) Kriya Therapeutics
c) Function of Beauty
d) Bioklab
e) Ōura
f) OneSkin
g) K18 Hair
h) None of the above