

CYCLING & INNOVATION

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Back in October 2020, Andorra Research + Innovation and Andorra Business founded the Andorra Sports Innovation Hub, a center for innovation focused on Cycling and Winter & Mountain Sports. Through the Hub, as well as many other activities, Andorra is looking to reinforce its position as an international destination for sports, business and innovation. GSIC powered by Microsoft and SPSG Consulting have been advising Andorra Business and Andorra Research + Innovation since the foundation of the Andorra Sports Innovation Hub.

In September 2022, the Andorra Sports Innovation Hub produces the second report of its kind, focused on the Cycling industry (after the one that was released and presented in July 2022 focused on the Winter and Mountain Sports industry). The significance of the Cycling sport industry is very relevant in Andorra. Not only because dozens of professional cyclists live in Andorra and take advantage of the privilege conditions (challenging climbs and mountains, beautiful scenery, world-class technical conditions, equipment and accommodation, etc.). But also, the fact that Andorra regularly hosts stages of the Tour of France and La Vuelta, as well as other international competitions (BTT/MTB among them). In addition, the cycling business ecosystem is growing, and enables companies to generate synergies and propel their businesses.

Andorra aims to build an environment with optimal conditions for start-ups and businesses, becoming a real “living lab” at country-scale for business development, in this case focused on Cycling sports. The objectives: to drive prosperity, improve the life of Andorra’s citizens, offer a better experience and conditions to our visitors and investors, and develop innovative and sustainable projects around its sports industry. With these commitments in mind, Andorra produces a report that aims to propel these aspects further, focused on one of its main sports: Cycling, its industry, and stakeholders.

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INTRODUCTION

Cycling appears simple: two wheels, one person, a road, a route or track, and a few hours of free time are required for this sport. However, the complexity of this industry becomes visible when one investigates the wide array of disciplines and stakeholders involved. Figure 1 illustrates this concept by providing the reader with an overview of the main sporting and non-sporting uses of a bicycle in its different forms. Cycling is not just a sport, it is also a part of other sports: triathlons and pentathlons. Additionally, it is a touristic and sustainability actor. It is not just an outdoor sport, it can be virtual and a part of many people's gym routine. "Unofficial" cycling disciplines – like free-riding – can be as popular as official Union Cycliste Internationale (UCI) disciplines, and amateur events can drive more people to regions than elite international competitions. This inherent complexity is what makes it so interesting for businesses and potential users alike. It is adaptable to different needs, abilities, and fitness levels. There is a bike for everyone.

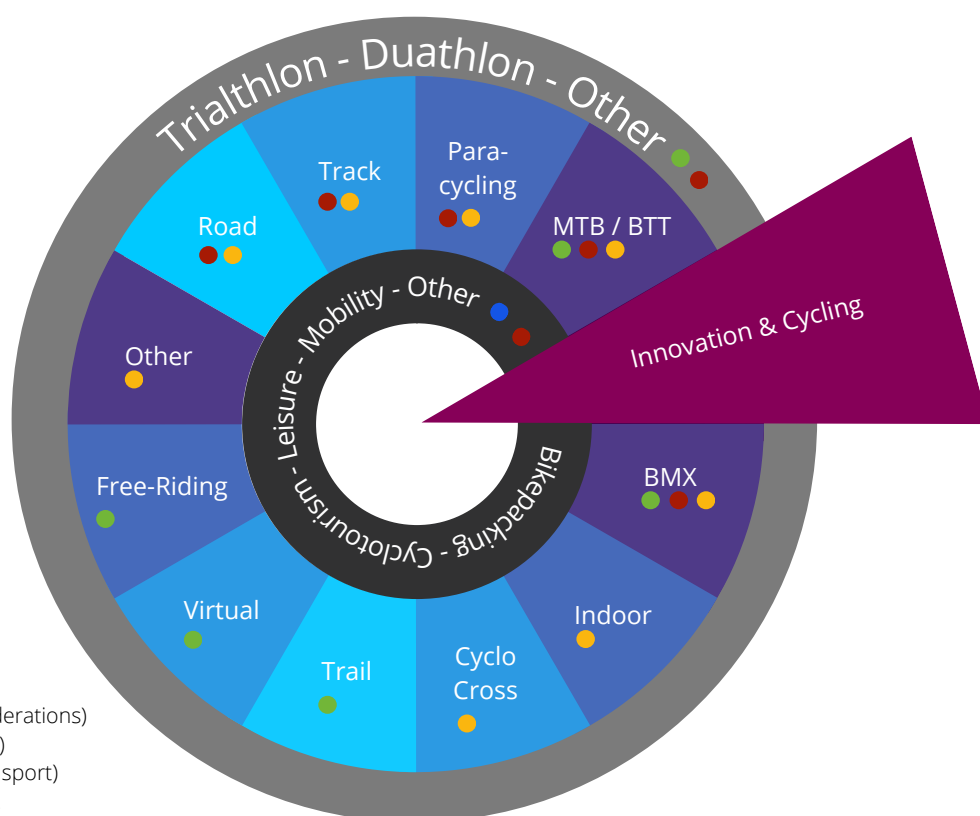
In an uncertain socioeconomic climate, cycling has managed to grow at an incredible rate, thriving despite it all. This increase in demand has enabled actors from the industry to innovate and undertake challenges like never before. Andorra is at the center of the cycling industry's development: as one of the leading cycling touristic, training and competition destinations, Andorra must ensure it delivers top-tier experiences for all kinds of cyclists. 165 million bikes are sold annually worldwide (1). The global bicycle industry was valued at over 95 billion euros in 2021, with experts predicting it'll continue to increase its value (from a 4.6% CAGR pre-pandemic to a 7.6% CAGR predicted for the 2021-25 period), especially after the growth of e-bike sales, and the consolidation of bicycles as a means of transport in major cities (2;3).

EU countries were some of the most positively impacted by the recent growth the industry experienced during the pandemic, with a 40% growth in sales to 18.3 billion euros. The highest sales figure from the past 20 years. It is true, however, that EU countries had already been investing in the industry's growth, over 1 billion euros in Research and Development (R&D) in 2019 (1;3). Andorra, the country in the Pyrenees, is experiencing this growth and digitalization first-hand. 7.7% of its GDP is generated by sport.

Andorra is home to a very large number of professional cyclists; its mountains provide optimal training conditions. Cycling infrastructure is a very valuable touristic asset: it de-seasonalizes ski-resort activities by utilizing the resort's mountains as Mountain Biking (MTB) circuits. Pic Negre, a peak within the Vallnord resort in Andorra, has a series of MTB-adapted routes. Vallnord has become a benchmark of MTB infrastructure in Europe, especially so for downhill. Andorra's cycling conditions do not only attract training professional athletes and tourists but also have the capacity to be successful homes to international events. With over 70 peaks rising above 2 000 meters in height, Andorra is host to several internationally renowned events: the MTB World Cup, an étape of the Tour de France and of the Vuelta, the Purito, the Gran Fondo MTB... (4). This reputation in the industry requires for Andorra to have a substantial stock of bicycles, which has made them a top country for bicycle import trading rates (5).

Figure 1: The cycling industry "wheel".

- Have their own organized competitions
 - Olympic modalities
 - UCI Modalities
 - Other Uses and Institutions
-
- Outer ring: other sports (have their own federations)
 - Middle slots: cycling disciplines (sport focus)
 - Inner ring: cycling activities (not focused on sport)
 - Transversal aspects: innovation and cycling.



Cycling, however, does not just cover sport and sportainment. The cycling industry is a very sustainability actor. The SDGs have countries aspiring to become greener, and bikes can contribute to this, given they are a very practical and low-cost mobility alternative. Should bicycles be produced and used locally (EU), a reduction of more than 2 million tons of CO₂ could be experimented (1; 6). However, the active and committed involvement of governing bodies is required for this to work (7). Adapting roads and pathways, developing an action plan and providing incentives to cities and citizens, are just some of the many measures institutions must account for and develop.

The purpose of this report is to present a global overview of the cycling industry from an innovation standpoint. The survey's methodology utilized secondary information, complemented by the results of an online survey among experts of the industry.

This document is composed of six chapters:

1. Impact of Covid-19's collateral effects
2. Digital Transformation Gap
3. Fan Engagement
4. Athlete and Team Performance
5. Media
6. The Workforce - Needs for - and Retention of - Talent



1. COVID-19: THE IMPORTANCE OF MOBILITY

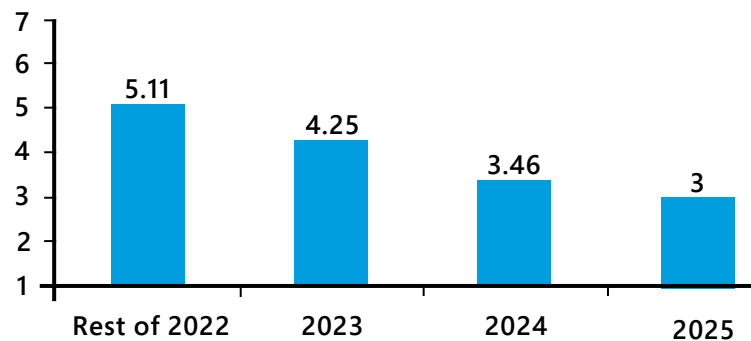
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Aside from digital assets, what has managed to grow in the past 2 years? This question might pose as a trap. The pandemic has brought on incredible distress to the world's economy and its biggest industries, including physical sports. It has accelerated oncoming changes: volatile consumer habits, digital innovation, climate awareness and action... The sports industry, especially the sportainment (combination of sport and entertainment) aspect of sport, has suffered economically like never before. However, a sport has managed to greatly benefit in the face of adversity. Cycling, an apparently simple sport, has grown exponentially on most fronts: Manufacturing and sales have skyrocketed. Usage has grown (both sports and mobility-wise) and innovation has done so as well. Spain has lived through this first-hand: the industry is now at almost 3,000 million euros in value and is set to either keep growing or consolidate itself at those outstanding figures (7). Communities have grown together with the industry, with indoor, virtual, and gamified cycling models accelerating their growth exponentially. The rise of players such as Bkool, Zwift, Rouvy, Strava and Peloton, among other developers and communities, have opened the sport of cycling to non-consumers, while having them engage with real cycling challenges. Additionally, cycling together with the NBA, was one of the few competitions to carry on during the pandemic. As an individual, no-contact outdoor sport, they were at an advantage. Bkool, Rouvy and Zwift have benefitted from this digitalization, launching and/or consolidating virtual gamified competitions. This might illustrate why the impact COVID is predicted to have on cycling in the years to come is sustained in time, according to the industry experts surveyed (not going below 3 at any point).

Interestingly so, industry figures do not tend to include sales of indoor and virtual cycling. This has experts thinking the numbers could be even more staggering: the apparently "sudden" growth of virtual cycling providers has attracted hordes of new customers to the industry, driving demand to a point where the businesses could not supply in time.

Despite the sports focus on the report, it would be unwise to ignore the fact that cycling's potential as a mobility alternative is growing much more than expected. Copenhagen (49%) and Amsterdam (35%) Europe's ranking of cities with the highest cycling rates rates (8). Governments are attempting to increase the number of cities that can provide safe and convenient cycling routes for citizens to commute by bike. Surprisingly, children are not the ones generating the recent growth in cycling commuting. The percentage of EU children that are walking or cycling to school has dropped by 68% in 30 years, an alarming fact that alludes to changing habits in the population.

The pandemic highlighted the need for a shift in exercise habit trends. Healthy individuals were statistically much less likely to suffer in the short and

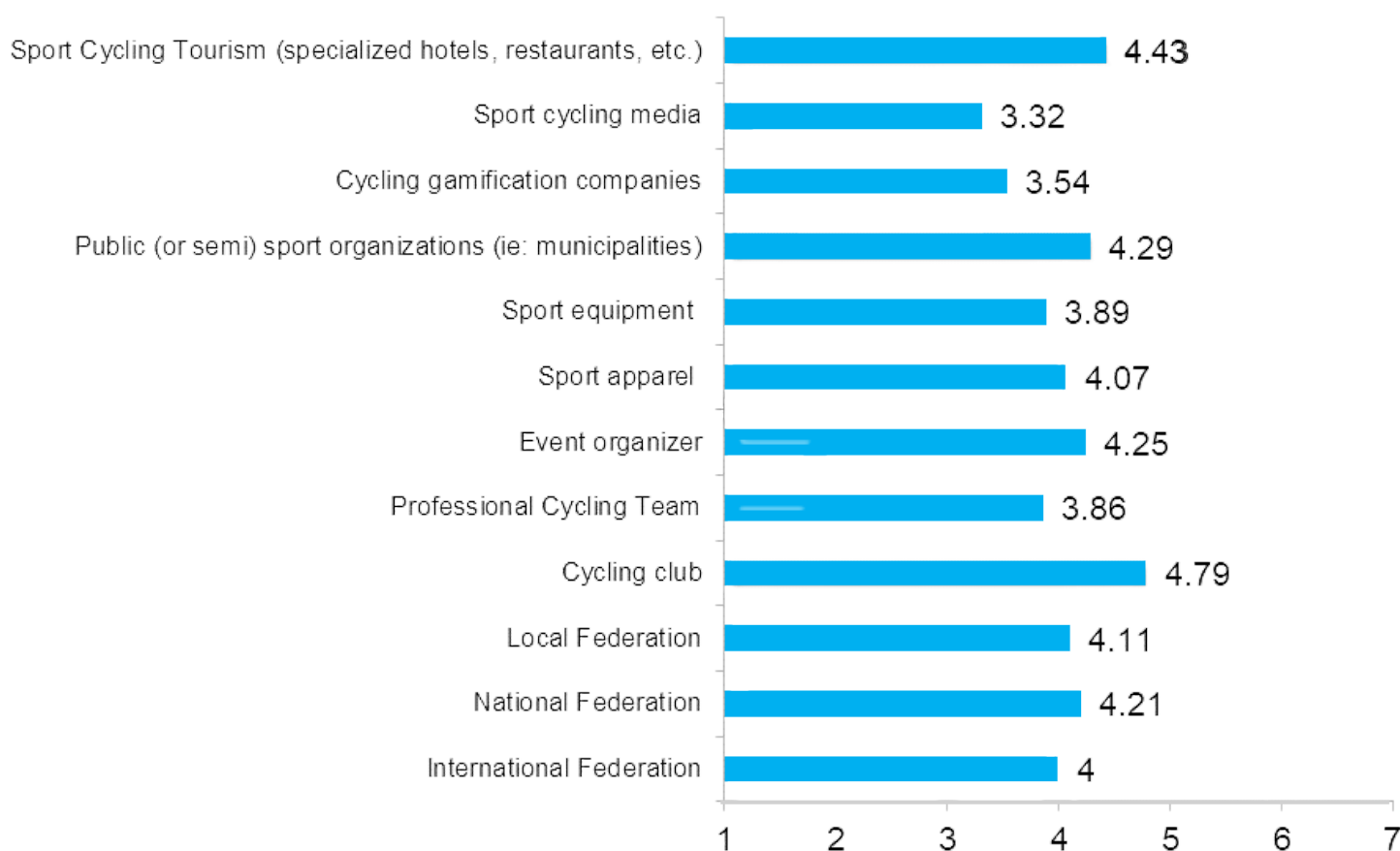


long term from COVID. Cycling can contribute to reducing the growth of sedentary behavior. The WHO, together with the United Nations (UN), drafted a "masterplan" to promote cycling as a sustainable mobility alternative (9). However, as of 2021, only 14 out of the 33 EU nations (including the UK and Switzerland) have a cycling action plan or a similar updated document in place (10). This information highlights the urgency of incorporating cycling strategies to the list of national priorities. The focus needs to shift for policymakers. Cycling is still physical activity even when the bike is used as a means of transport.



2. DIGITAL TRANSFORMATION GAP: WHERE THE STAKEHOLDERS ARE

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Respondents were asked to rate, on a scale from 1 (being minimum) to 7 (being maximum), the digital transformation gap of a non-exhaustive list of cycling industry stakeholders. All stakeholders received a relatively high score, with cycling clubs, sport cycling tourism stakeholders and municipalities at the top of the ranking. Amateur aspects of cycling (via cycling clubs, with a score of 4.79) are reasonably considered to have the highest gap in digitalization.

The cycling ecosystem is complex. It requires extensive coordination (especially in road bike modality) for competitions and sport practice to take place. Digital innovation has contributed to the safety and increased performance of athletes (see section 4), and it should also contribute to the growth and consolidation of other stakeholders in the industry.

An incredible advantage for cycling is the relative low-cost of practicing the sport statically, as in not requiring the road or the mountains to stay in relatively good shape. Gamified cycling has yet to adapt to the rough terrain of off-road cycling and, evidently, to the acrobatic forms of cycling. However, one doubts it ever will: the attractiveness these types of cycling

have is the discovery of the unknown and the interaction one has with nature. See for instance, enduro and gravel, two relatively new modalities of MTB that have arisen and depend on the unique, unpredictable characteristics of the terrain.

Examples of incredibly fast innovation, especially in the past 5 years, are cycling gamification and virtual cycling companies. Products like the ICG Connect System, which allows riders at an indoor cycling gym class to view their data and integrate their performance with real road biking scenery from around the world, have made indoor and home-cycling more attractive for non-users and casual users. Bkool, a virtual cycling application, partnered with Giro d'Italia (one of the most important international road cycling competitions in the world) to offer Bkool users the possibility of doing *étapes* of the Giro on the platform. This “virtualization” of cycling competitions has just begun, and it will probably continue to grow at astounding speeds given the technological advancements in recent years. Further analysis of the possibilities of engagement in gamified cycling can be found in section 3.

However, this evolution can be compromised if the relevant governing bodies do not act by allowing this innovative streak to continue. Local and national federations are generally following the lead of UCI standards, which thankfully, is managing to stay up to date at astounding speeds despite its size. Due to their reduced economic power (in comparison with other sport industry entities), federations are looking for technological allies to digitalize their structures and processes. Examples of these alliances include the Spanish Cycling Federation and Decathlon, partnering to develop gamification programs and digitalize the federation ([11](#)). British Cycling (BC) are currently sponsored by Total computers, a national provider of IT services, to digitalize and improve the accessibility of BC's several education programs ([12](#)). Innovation on a smaller scale can also be achieved: Australia Cycling, for instance, is a federation that offers their cycling license in Apple / Android “Wallet” format ([13](#)). This illustrates how federations can take action, even if the steps are small and have no private tech partners to support them.

Municipalities, also known as local governments, are one of the – if not the most – important public partners cycling should thoroughly and effectively communicate with.

Municipalities, as local regulators, are responsible for either driving or halting cycling activity. This is especially true for amateur cycling, “cyclo-tourism” and mobility. Estonia is an example of a country with a digitalized touristic roadmap for both road and mountain biking. It also includes routes from Eurovelo, Europe’s bikepacking travelling guide (available online) (14; 15; 16). The routes do not just include the pathway cyclists are to follow, they also list amenities, weather and track conditions, and checkpoints along the way. This leads into the importance of digitalization, in order for stakeholders to be at the front lines of the development and evolution of the IoT (Internet of Things). Cycling’s importance arises on the mobility-specific aspects of this engineering and digitalization evolution: there is a need to cohesively develop Intelligent Transport Systems in cities, which includes bike commuting and cyclo-tourism. The ITS World Congress 2021 in Hamburg, highlighted the importance of including the bicycle into ITS ecosystem development programs (17). Three pillars were listed as priorities to successfully carry this out:



Change in consumer behaviour and modality shift: combining cycling with other services, bikesharing, and cooperating with Mobility as a Service (MaaS) businesses.



Smart bicycle and rider: advancing in bike technology development, in app and digital mapping development, as well as accounting for unique bike commuter needs such as traffic, parking availability, route planning and others. Providing enough data for cyclists to make an informed decision.



Interactions: ensuring a cohesive and integrated ITS ecosystem to ensure effective interactivity and safer mobility.

All these pillars cannot work without correct data management, collection and analytics. In section 4, we look at the implications data has had, and will have, for athletes. Furthermore, it is relevant to note that this evolution of cities and countries from analogic to digitalized requires investment in R&D, allowing for private initiatives to develop, and fostering constant communication between stakeholders. Andorra’s government is successfully developing this, with the help of private companies. It accounts for, like the state of Ottawa to name one, both off-road and on-road biking. Digitalization oftentimes “rejects”, unintentionally so, the rural environment. Andorra, on the contrary, is very successful at remembering the countryside due in part to its reduced size. Another important aspect for Andorra, and many others, is the almost immediate increase in tourism and attractiveness road cycling event host regions gain from their TV appearances during those events.

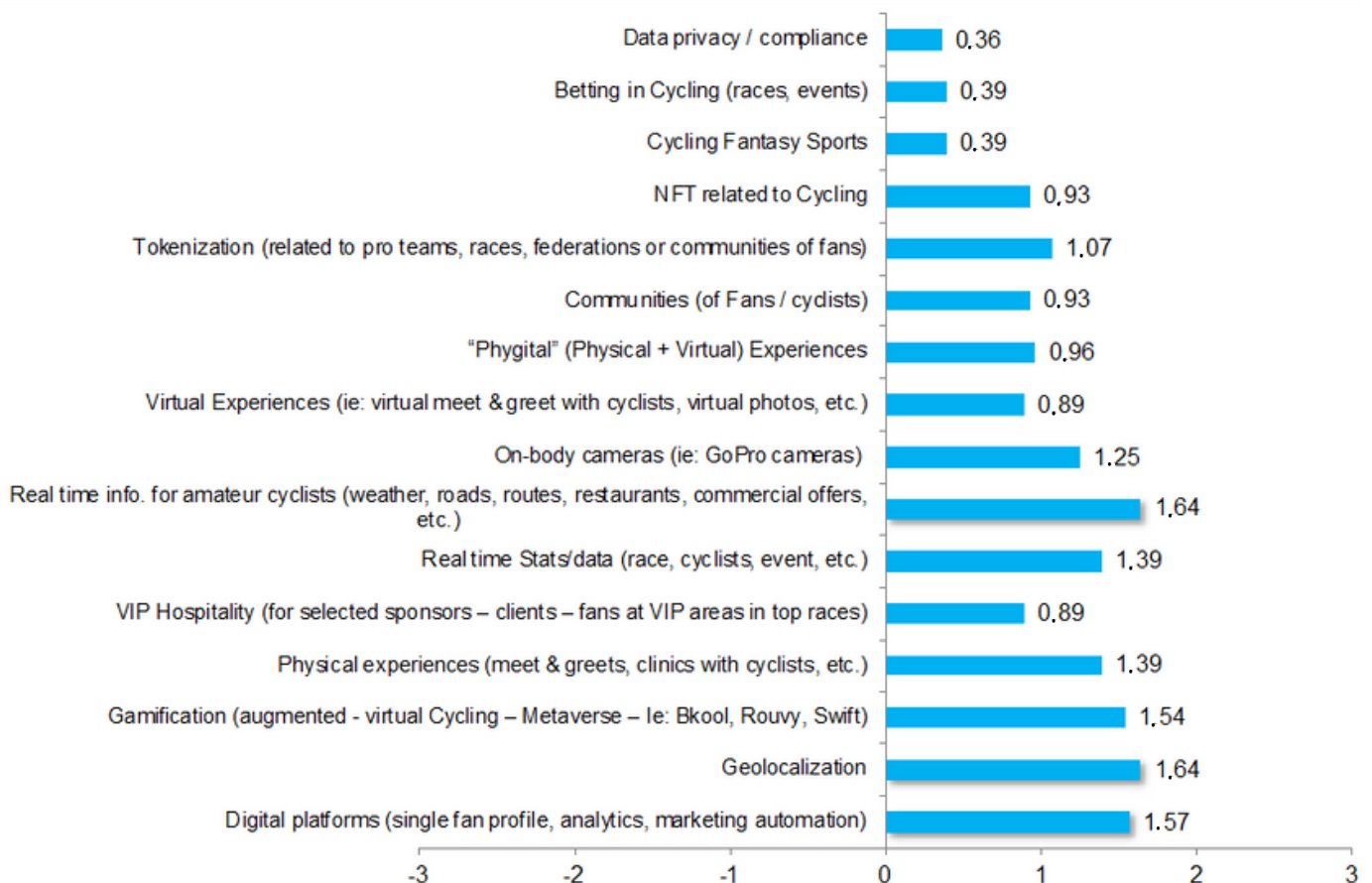
Barcelona will invest around 1 million euros to be the starting point of LaVuelta in 2023. Galicia's government invested 400,000 euros to host the end in 2021 (18). But cycling competitions do not just contribute to the consolidation of already touristic cities, they also popularize small countries, towns, and villages. It is therefore of extreme importance for media outlets and governments to communicate so the best version of the filming locations shines during competitions. Cycling media brings it all together. Extreme versions of cycling would've not been as attractive to watch if it weren't for RedBull's continued effort to produce content with the highest quality. Events like MTB Rampage (19), which displays one of the most extreme versions of mountain biking, would not be as watchable or attractive if it weren't for the storytelling and incredible visual mastery of the brand. It would be interesting to see how digitalization can aid media in producing content that benefits not only fans, but also the communities, where cycling events take place in.

Events-wise, cycling has a very well-known ally when it comes to popularizing the sport. Triathlons – specifically Iron Mans – are benchmarks of fan engagement, digitalization, and stakeholder consideration. Cycling benefits from this tight-knit passionate community, and it should aim to engage with them further. This requires development of a streamlined and clear communication system with the relevant triathlon governing bodies, to generate a win-win, data driven relationship.

The starkest contrast one should find in digitalization is the one seen between cycling clubs and cycling teams. Cycling clubs involve, for the most part, amateur cyclists that enjoy biking together. Teams however, are professional, massive structures. They want their athletes to succeed at the biggest events. This is evidently seen in Road cycling: cycling teams are immense: the complexity of the sports warrants it. Therefore, the structure tends to be more digitalized and professionalized. Cycling clubs ought to aim for teams' digital assets, especially those related to safety and security. Please refer to section 4 for a further analysis on digitalization aspects that pertain to athletes and teams. Because of cycling's strong touristic pull, we can see stakeholders have wanted to adapt and digitalize their strategies, to provide smooth, quick and streamlined processes. However, centralized access to relevant regulatory and touristic information is lacking in most countries. Non-governing stakeholders would greatly benefit from more accessible, intuitive, and diverse information and plans. Additionally, it is surprising to see a disability-inclusive sport like cycling without a readily available accessibility digitalization plan.

3. FAN ENGAGEMENT:

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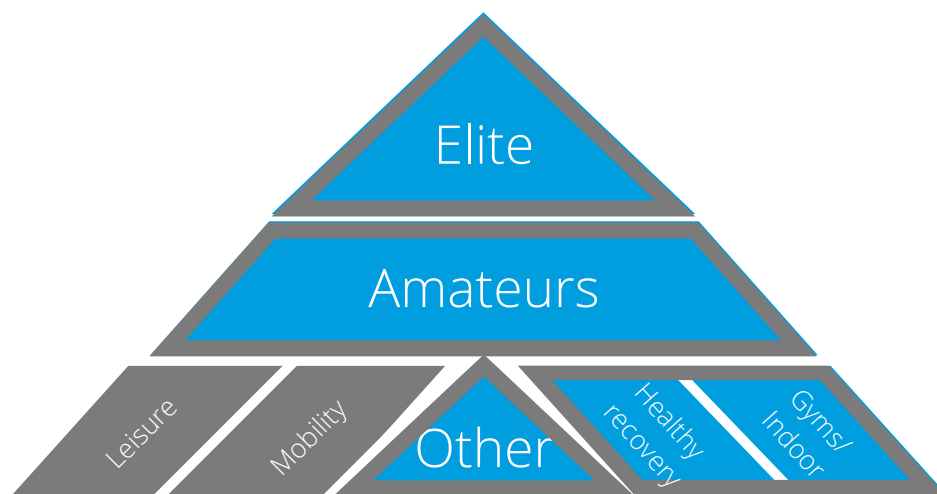


Respondents were asked to rank the degree of evolution (negative (-3) to positive (+3)) in several different aspects of fan engagement in the years to come.

Despite the digitalization gap, respondents noted for amateur cycling clubs in section 2. They recognize it will probably be one of the fastest to evolve in the near future (1.64 points). It is slightly surprising to see data privacy, betting and cycling fantasy sports with such low evolution scores, the latter even more so, seeing the success of, e.g., the F1 online fantasy game.

Cycling has evolved immensely during the pandemic, especially on the engagement front. It used to be a passive watch time sport. However, the diversity of the industry and its disciplines should warrant a wide variety of engagement opportunities. This is an increasingly relevant aspect for sponsors when negotiating sponsorship packages. Offering sponsors the possibility to interact with the fan, provides unique experiences and make the sport more engaging. This should be a priority in the years to come.

The fan engagement pyramid in cycling offers sponsors many possibilities. Cycling “fans” are diverse: they can engage with brands virtually / online, at indoor cycling gyms, outdoors in a cycling club, at amateur competitions for avid fans like the Skoda Titan Desert, or as viewers of LaVuelta (see figure 2). Therefore, it is important for all cycling disciplines to digitalize themselves in order to understand how to better engage with the audience they – and their sponsors - converse with. Skoda is a formidable example of awareness generation due to their partnership with the titan desert, one of the most extreme unofficial amateur MTB competitions in the world. The 2021 SPSC Consulting Sponsorship Barometer quantifies this:



Blue: Online
Grey: Offline

Figure 2: Cycling participation pyramid. Bottom (more people) to Top (less people). Supports the wheel.

The top 3 sponsors for cycling were Movistar, Carrefour, Cofidis and Skoda (tied in third place). In the 2020 barometer, Skoda was not even in the top 10. Interestingly so, all the sponsors except for Skoda are mainly present in road cycling. This should serve as a starting point for the other cycling disciplines to develop stronger sponsorship packages. RedBull for instance, managed to finally generate public awareness on their long-term involvement with alternative forms of cycling and occupied the 7th position on the 2021 barometer.

Understanding our Fan

To develop digital innovation in fan engagement strategies, stakeholders involved in the fan's engagement journey must prioritize the development of fan profiling, analytics, and automation systems. Understanding the cycling fan requires understanding of, and involvement with, the communities they are a part of. Cycling is a very social sport, especially for the amateur avid fan and casual leisure fan. Cyclists are incredibly passionate about equipment and data, probably the most passionate sportspeople in the sports industry. The intensity and difficulty of the sport requires dedication, which generates very avid communities that are currently not being exploited to their full potential offline. Online communities have gained traction and do count with digital systems that can contribute to add value.

Most cycling events are free to watch in situ, so profiling offline fans can only be done conducting research on those at the premises who voluntarily agree to do so. A permit system or bracelet system to ensure safety crowd measures are met, could contribute to more reliable data collection, amenity usage understanding, etc. This information is meant to be utilized later to add value to attendees, provide sponsors with interesting activation strategies, and drive more audiences to events. However, media, event organizers, and press companies are at an advantage, they do have more sophisticated data collection systems, as well as the power to decide upon virtual / remote engagement strategies. They will be the main drivers of innovation. Their biggest weakness lies in driving organic, casual fan traffic to cycling. Storytelling has played a significant role here (see section 5). The concerns for data privacy, profiling, automation, and analytics are similar to those in other sports and other industries. The importance lies in finding a way to package them and target the right, susceptible people.

Rutland cycling is an example of how fan engagement goes further than viewers in cycling. Rutland cycling is a bicycle retailer that did not have an integrated digital ecosystem to capture and retain more consumers. They relied on a technological provider to integrate and modernize their whole digital ecosystem, successfully so (20). Internal improvement leads to external benefits.

Data revolutionized sport, there's no doubt about that. It revolutionized fan experiences, teams, and competitions. Real time data and stats are an incredible engagement generator for viewers and motivator for amateurs. When this is tied into fantasy sports and betting practices, user profiling and monetization reach new heights in this sport. Cycling is yet to find ways to integrate phygital experiences into live broadcasts of the sport. The duration of competitions makes it almost mandatory. Notifications, multiscreen, engagement generators (via fantasy, betting and other) need innovation. Especially knowing these aspects are drivers for casual fan engagement, given these fans are stricter in that they are looking to be entertained.

Avid fans are strict in a different way. They want to be updated, to have all the information and to be offered exclusive products, experiences, and services. The theoretically speculative nature of NFTs warrants waiting time. Tokens, however, would be a great opportunity for teams and competitions to engage further with fans by providing them with benefits and experiences: being in the team car, get photographs, participate in documentaries, facetime sessions, training sessions...etc. VIP hospitality on the road is difficult, but not impossible: a sponsor bus/car, for instance, with Food and beverage, dinner and/or lunch post competition with the cyclists...etc. It is relevant to note, however, that there are attempts of NFT development in the industry: BikeClub is a cyclist NFT community with ESG as the focus of their activity, they were set to launch in summer 2020 [\(21\)](#). Movistar Team, a road cycling professional team, recently launched a series of NFTs [\(22\)](#).

However, the avid fan's engagement experience can also be physical. The UCI will launch a new competition format in 2023 that will unify all cycling disciplines. It was announced that Glasgow will host the event, providing avid fans the opportunity to engage with the other disciplines of the sport they're interested in, while also centralizing all events to specific dates for casual fans, elevating the entertainment experience and offering the potential use of multiscreen technology.



An aforementioned aspect of cycling that has evolved rapidly and allowed avid and casual fans alike to generate communities is gamified virtual cycling. Sponsorship and partnership generation have just started to take off here.

Generating virtual communities is now more important than ever, after the announcement of a centralized digital universe called the Metaverse. Bkool, partnered with Giro d'Italia, is an example of a partnership accelerated by the recent pandemic and technological announcements. The use of influencers like, in the case of Bkool Alberto Contador ([23](#)), to support these innovative products, will generate credibility and further grow these communities.

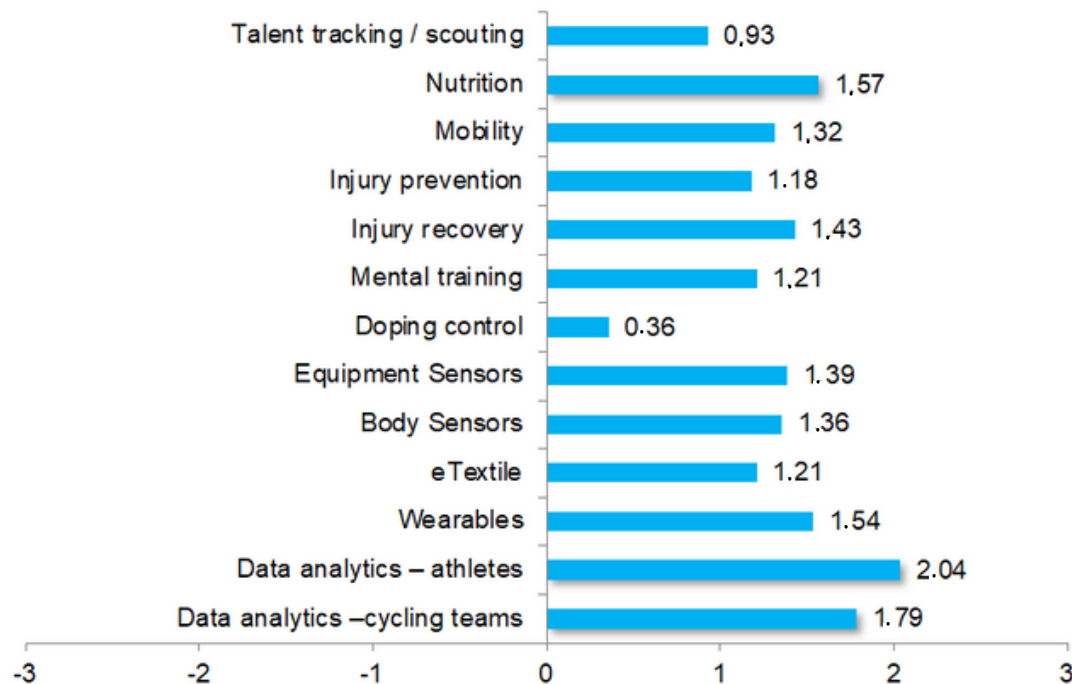
Tourism is Engaging, Especially in Cycling

Amateur cyclists have a chance, while travelling to cycling destinations, to try and imitate professionals. Digital engagement strategies that safely display their idol's timings on each *étape* while they see how they match up against them would be of great interest for avid cyclists. Displays integrated with the environment should be a piece of equipment soon to be developed.

Andorra is one of the most successful countries developing an engaging digital ecosystem for sport cyclists. The sport is one of the country's main strategic touristic products. They have fostered the success of private initiatives that provide avid cycling fans with unique training experiences packaged with amenities ([24](#)). However, they have still accounted for beginners, offering alternatives to difficult roads and pathways. Additionally, Andorra has a wide variety of accommodation catered to cyclists, as well as cycling guides for those who prioritize safety. The potential for innovation here is immense: Andorra's public and private stakeholders are coordinated and adaptable, so digitalizing some of these services and routes would not be an extremely challenging feat. Interconnectivity, sponsored routes and paths, etc. are some examples of interesting digital innovation practices for engagement from a touristic standpoint.

4. TEAM AND ATHLETE PERFORMANCE

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Respondents were asked to rate the degree of evolution different aspects of team and athlete performance would have in the years to come. Data analytics stands, unsurprisingly so, at the top (2.04 for athletes and 1.79 for teams). Nutrition and wearables follow closely (1.57 and 1.54 respectively). Despite the complexity of the industry, the sport needs equipment to be as practical, lightweight, and sophisticated as possible to ensure maximum efficiency and performance. This includes the person (its nutrition, mental training...) and the equipment (wearables, textiles...).

Cyclists are the “nerds” of sportspeople. The incredibly wide variety of equipment options and configurations, as well as the possibility of developing bespoke equipment for top athletes, has avid cyclists constantly searching (and purchasing) new equipment. Shimano, one of the most popular bicycle components brands, grew substantially this past year, on par with the industry (25). The biggest hurdle for equipment and performance improvement in athletes and teams is the nature of cycling. It is a mobility-based sport, that requires concentration and a clear vision without distractions, primarily for safety reasons. This has been backed up by research literature (26).

Cycling is an extremely data-driven and hard-skill-based sport. Therefore, it is not surprising to see the amount of technology in professional cycling teams. Italy's national cycling team utilized 3D scanning to ensure optimal bike and rider aerodynamics ([27](#)). Trek offers an incredibly wide array of bike computers, GPS, sensors and other tech accessories ([28](#)). Most equipment is small in size for both aerodynamic and safety purposes. However, integrating this equipment into the bike and into the protective equipment has room for development. Where there has been a recent surge in research is in e-textiles: luminous, temperature regulation, vital sign measurements, and many other aspects have been developed, woven into clothes. Self-lighting wearables have very positive potential safety implications; however, all kinds of wearables require refinement because the technology is still relatively rudimentary and have relevant sustainability implications ([29](#); [30](#)). One of the first businesses to integrate technology into safety equipment while respecting comfort and competitiveness is Evix. Evix (winner of the second edition of the Andorra Sports Innovation Hub Challenge) created a cycling helmet with incorporated airbags and safety technology, with great success ([31](#)). These kinds of advancements and innovations would greatly benefit from more sophisticated sponsorship programs. Jumbo Visma, a road cycling team, integrated one of their sponsor's campaigns into their new tires to bring attention to the team, equipment, and the sponsor ([32](#)). Transversal activities like this one should be the norm, not the exception. They drive entrepreneurship and foster healthy competition.

An additional performance and safety concern for cyclists is bike fitting. Developing digital systems that "check the whole bike" for the cyclist before they start a competition could reduce accidents and improve performance.

Talent tracking and talent scouting feeds directly into equipment improvements. At the moment, most talent scouting and tracking businesses are traditional. They can take the form of agencies or academies, where talent is either managed or developed. Athletes, when they are successful, are usually within both. Literature and evidence-based computer-aided talent identification software is currently scarce and underdeveloped in cycling. Recent scientific literature publications have attempted to create a framework for this purpose with relative success ([33](#)). British cycling is an example of the intensive and extensive investment talent development requires. Digitalizing this aspect will reduce costs for teams and federations.

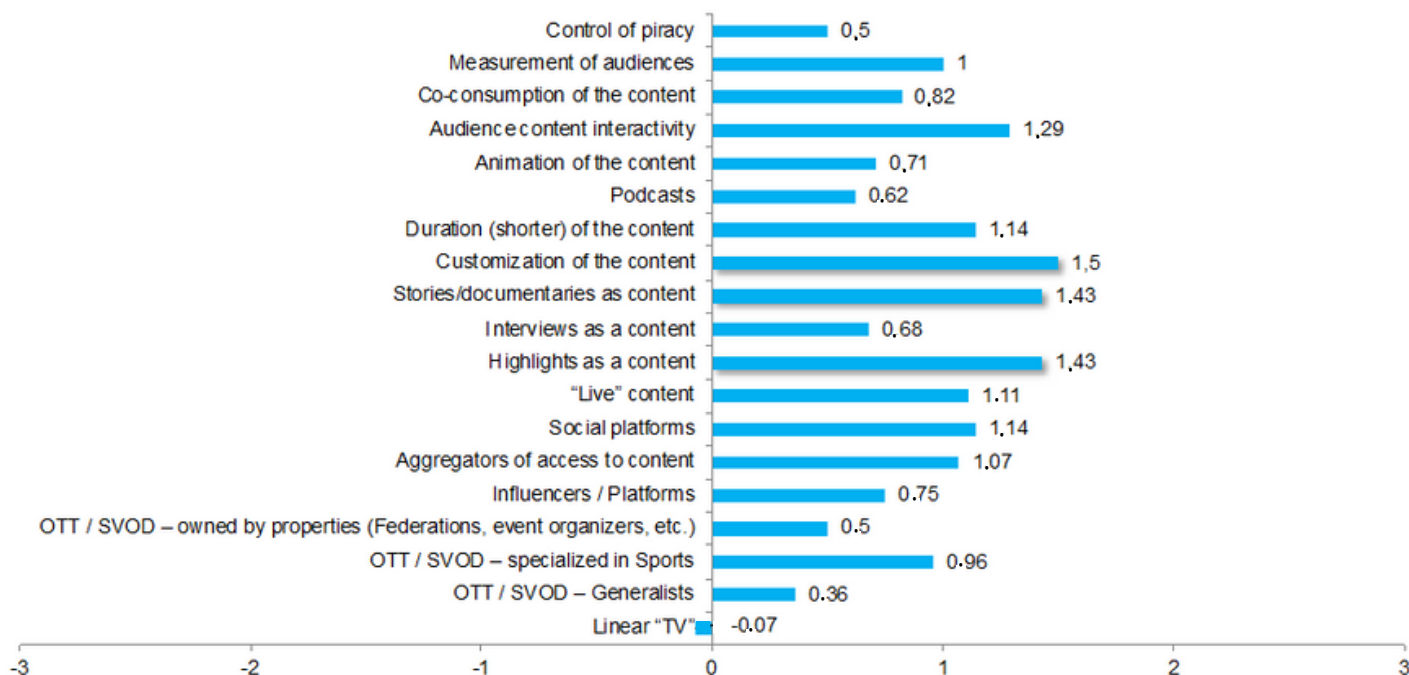
Injury prevention pertains aspects of equipment already mentioned, like integrated technology, bike checking systems, etc. Information on the specifics of training, injury recovery and nutrition are all very similar to other sports. Cyclists must adapt their training regime to perform well at high altitude. Additionally, their sport requires simple carbohydrates for short bouts of very intense activity, as well as complex slow-release carbohydrates for long bouts of medium intensity activity (especially true for cross-country, cyclo-cross, bike-packing and road biking). The sport is very demanding on one area of the body... the legs. Developing wearables or e-textiles that can identify when the legs are overexerting themselves or need a certain nutrient would be of great use for athletes and teams. Doping is of course, a concern here, but its coverage is beyond the scope of this report. Additionally, respondents did not consider doping would evolve as much as the other aspects (receiving and average score of 0.36 points). All competent cycling stakeholders are searching for a way to technologically advance and sophisticate doping controls.

Nutrition is closely tied to injury prevention, performance, and recovery. Intelligent systems are under development constantly in this area, not specifically to cycling, but to all sports. LogMeal, one of the finalists of Andorra Innovation Hub's Startup Challenge 2022, utilizes AI to identify the nutritional values of people are having. Other interesting, but slightly more unreliable systems include DNA analysis to find the ideal nutrition plan for a person's genetic makeup (34). Interestingly enough, online / gamified cycling has caught the attention of scientific literature, with several papers discussing how online cyclists should eat when exercising (35). Finding a way to integrate nutrition reminders or record a person's data and recommend meals based on the data, would be a groundbreaking and very practical combination for this category of cyclists. Andorra has, for instance, developed an entire industry around sports medicine called Andorra Health Destination. One of the programs they offer is tailored to cyclists, developed by the Omega Z Practice.

There is one final aspect that can completely boycott every single athlete if they do not train it: the Mind. Cycling possesses an incredible mental challenge for anyone who wishes to try overcoming themselves. Brain Data sports, a member from the GSIC powered by Microsoft ecosystem, utilizes evidence-based technology and systems to help football players "dominate" the mental hurdles they might encounter in their career.

5. MEDIA

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Respondents were asked to rate the evolution of several media-related aspects. Content customization, storytelling via documentaries and the shortening of content through highlights were considered to have the highest potential evolution in the years to come. However, it is interesting to note that, despite this evolution being positive, the score is relatively low. None of the top aspects has an average over 2 points.

Cycling is one of the most followed sports universally. Around 30% of Spanish adults claim to watch cycling on screens (36). The sport is also taking steps to reduce the media coverage and competitive gap between male and female cyclists, LaVuelta for instance created the Ceratizit Challenge, one of the few road bike competitions for women (37), and El Corte Inglés, an established Spanish brand that sponsoring one of the most important female amateur cycling events of the country (38). Movistar, on the other hand, is also investing in popularizing and fostering female cycling. However, women's participation is not the only relevant challenge to tackle. The duration of long-form cycling competition content is one of the industry's biggest problems. Fortunately, there are ways media stakeholders are trying to make content more attractive and engaging.

It is of relevance to note that the owners of the biggest amateur and professional cycling events are mostly media companies or big agencies. Giro d'Italia's owner is RCS Media Group, one of the biggest media companies in Italy. Big agencies and media companies owning teams and/or competitions enables them to produce content and tell stories they might've not been able to tell without this power ([39](#); [40](#)). Additionally, they can recycle and reuse content for their benefit, RedBull and Discovery being great examples of this ([41](#)). After the success of the "Drive to Survive" Formula 1 series, Netflix has invested in a similar model for cycling ([42](#)). Giving casual consumers an understanding of the trials and tribulations of the sport might drive viewership. A successful example of a recent cycling documentary is "The Least Expected Day" by Movistar. Stories and documentaries can also act as promoters of values and social justice: "Uphill climb", a documentary focused on the difficulties women in cycling face, while also promoting their sport, is set to debut in 2023 ([43](#)). Furthermore, the use of influencers can help drive the sport forward. Movistar's documentary accidentally manufactured new "heroes" of the sport. The problem of live broadcast length remains, however.

Further development of AI technologies for live recordings, as well as exploiting the possibility of utilizing multi-screen is a way media companies can reduce the need for onsite manpower.

Interactivity, Co-consumption and Animation – Engagement

There is room for innovation in cycling when it comes to interactivity, co-consumption and animation specific to the sport. Cycling gamification companies have driven this aspect forward, but when it comes to those who do not actively engage in the sport to interact with the broadcast, we find an ocean of possibilities. Live betting and fantasy gaming are still less developed compared to other sports and events.

All this digital interaction must be backed by solid cybersecurity measures, as well as antipiracy frameworks. Sports' income highly depends on media rights purchases. If watch time or view-count decreases because there is a free, illegal way to consume the content, the whole industry can be at risk. Synamedia, an agency specialized in sports, has recently developed antipiracy software that positively contributes to media, organizers, and athletes ([44](#)).

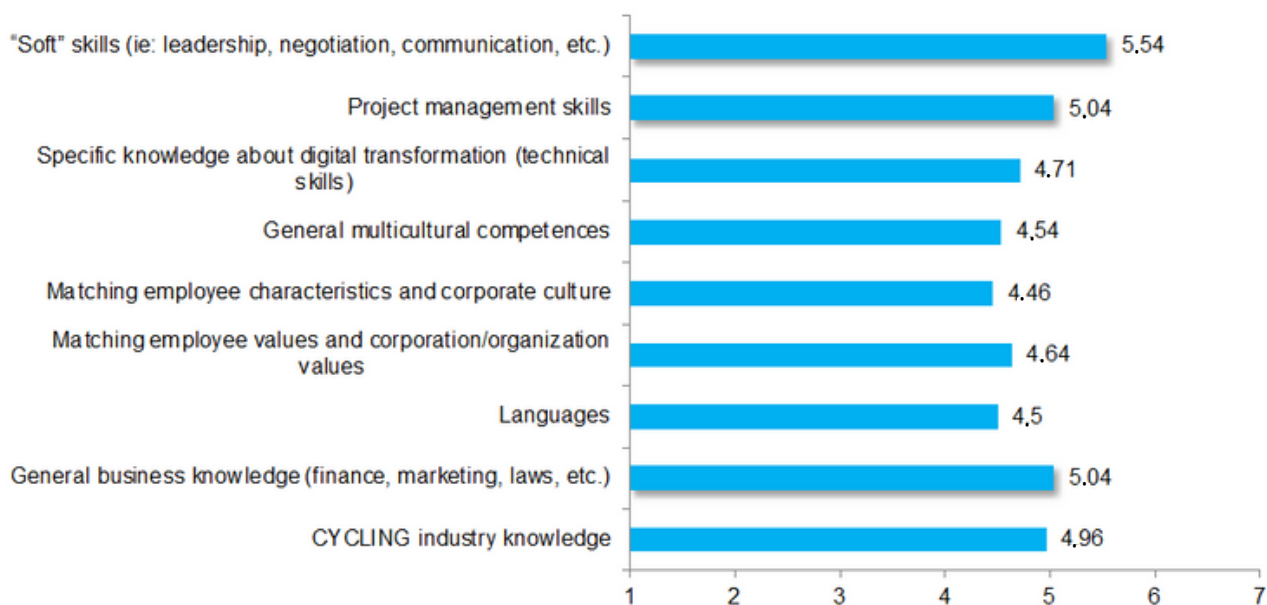
6. THE WORKFORCE: NEEDS FOR - AND RETENTION OF - TALENT

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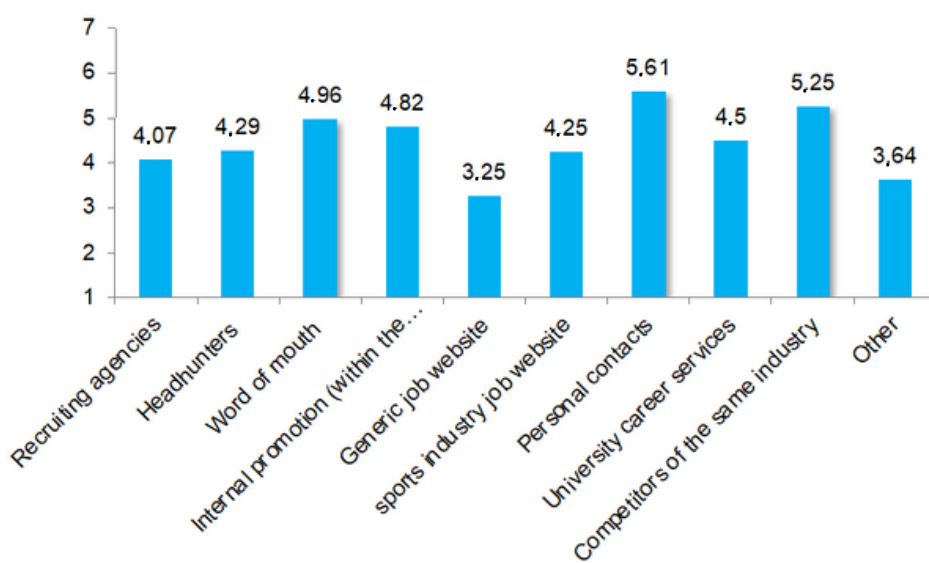
The cycling industry is a very interesting one: bicycles are small computers, extremely sophisticated “machines” with almost infinite customization opportunities. There are very different types of bicycles, each specifically manufactured for the sport they perform best in. Bicycles also require proper, specialist fitting, and they tend to break quite easily when used at a professional level. Many stakeholders are involved: wearables manufacturers, bike shops, manufacturers... Many of these do not only require a wide array of soft skills, but also require a set of hard skills. The industry needs engineers, mechanics, fitters, physios, all of which require specialized training. Additionally, the number of components in bikes (especially bespoke ones), requires coordination between different manufacturers from international markets. A profile experienced in logistics and supply chain management is therefore almost mandatory. This need for a variety of profiles clearly transfers into cycling teams, massive structures of people with very specific talents. However, a different way of monetizing the sport is urgent, because 90% of these structures’ income depends on sponsorship (16), making them very fragile in the face of uncertainty.

In total, the bike industry supports around 850 000 “green jobs”. It has been named this way by a cycling industry expert who believes in the positive environmental impact of a cycling mobility strategy (1). Digital Direct-to-Consumers (D2C) business models are trying to take off, small businesses unsuccessfully facing off against the big retailers and manufacturers. This might be why physical retailers are closing, despite skyrocketing sales during and after the pandemic. Small physical retailers must find a way to provide consumers with an experience at the shop, and digitalizing aspects of the selling experience might help speed up and make the selling experience much more enjoyable. However, to drive employment and ensure success of businesses within the industry, governing bodies must take a step forward and define strategic cycling plans. Well-defined strategies drive employment, usage, and industry growth. The first country to develop a cycling plan from a mobility standpoint was the Netherlands in 1990, followed by Germany in 2002 (45).

Two questions and their respective answers conform this section. One must dive into systems required to attract and retain working talent, while defining the necessary skills for a role in this industry. There is an evident trend that appreciates digital, transversal, and soft skills over hard skills, especially in management and client-facing roles. It is true that without soft skills, a perfectly qualified candidate will not succeed as much as someone who does have them. For digital transformation to occur in an industry, hard digital knowledge is required. However, without the support of a certain soft skillset and experience, this transformation is much less likely to thrive. For digital transformation to occur, there needs to be an environment that allows startups to flourish. Additionally, cycling possesses a challenge in its diversity: if a candidate desires to work on an aspect permeated by cyclo-tourism in any of its forms, language knowledge is a must. If manufacturing needs workers, then supply chain management experts, engineers and IT developers are more attractive profiles. All of which require a hard skillset. Again, like in many industries, cycling needs to find a way to be attractive to (Science, Technology, Engineering, Math) STEM experts to accelerate their digitalization.



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As a novelty-addicted sport, the industry must keep its workers updated on policies, technologies, and competition regulations. Added to that challenge is the fact that the world has entered an era of constant evolution. Sustainable

workforce education strategies, accompanied by employee retention strategies is paramount. Workforce “churn rates” are preoccupying businesses. In a very demanding socioeconomic climate and a competitive environment, it can be startling for some to see how swiftly some new workers let go of their jobs. Loyalty, for the most part, comes when employees are offered satisfactory, varied and challenging enough tasks and jobs. If the worker stays in their comfort zone for too long, the possibilities of a new job seem more attractive.



7. CONCLUSION: THE TAKEAWAY MESSAGE

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Where other sports have struggled, cycling has managed to thrive, despite the adverse conditions. Andorra, a country where an astounding 7.7% of its GDP depends on sports, could fortunately evolve, and improve its conditions for sports and tourism businesses during the same time. The growth of the cycling industry is good news for Andorra, and it will almost certainly contribute to their positioning as a hub for sports, entrepreneurship, and digital innovation.

Cycling is a paradoxical sport, both complex and simple in nature. In this paradoxical nature lies its adaptability, capacity for innovation and accessibility. Ignoring its potential for further digitalization and universal utilization will affect (in the medium to short-term the economies of the countries that choose to involve cycling in their strategies.



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