From Simulator to Racetrack: How the World of Esports and Video Games Is Shaping the Future of Motorsport

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Abstract: The combination of motorsport and esports in the last decade has opened up new horizons in talent management and driver preparation. This study uses qualitative methods (semi-structured in-depth interviews and content analysis) to investigate the contribution of esports, in particular sim racing, to the discovery of young talent and the continuous development of active professional drivers. The research gathers the experiences of Hungarian experts who have achieved outstanding results in both the virtual and physical racing worlds and thus have an insight into the crossover between esports and real racing. Our result's show that simulation offers a cost-effective, flexible and safe way to develop driver skills such as reflexes, decision making, stress management, and can also serve as a complementary tool in the preparation of elite athletes. All this supports the assumption that esports and sim racing are no longer just games but an integral part of 21st-century motorsport, a key element for competence development, talent management and innovative training methods.

Keywords: esports, sim racing, motorsport, talent management, online space, cost-effectiveness, skills development

1 Introduction

The convergence of motorsport and the digital space represents a transformative shift in the industry, driven by the escalating cost and infrastructure requirements of traditional racing and the high-fidelity opportunities offered by simulation

platforms. According to the 2021 Global F1 Fan Survey, over 51% of fans regularly engage with motorsport-specific video games, a figure that rises significantly among the 16-34 age group [1].

The academic relevance of the field is further underscored by its rapid bibliometric expansion within high-impact scholarly databases. A preliminary bibliometric search (Web of Science and Scopus, 2021–2025) indicates substantial scholarly activity in this emerging field. The search identified 376 peer-reviewed articles in the Web of Science Core Collection[1] within the Business, Management, and Sport Sciences categories, and 1,030 documents in Scopus[2] across the fields of Social Sciences, Business, and Health Professions. This scientometric trend signifies that esports has transitioned from a niche interest into a legitimate, multidisciplinary academic domain encompassing sports management, psychology, and innovation studies, a development already identified in early domestic sport-economic analyses [2].

The practical validity of simulation technology is further reinforced by its integration into professional education and vocational training. In professional road transport, for instance, Hungarian regulations mandate the use of simulators in truck driver training to prepare operators for complex road conditions and scenarios [3]. These professional applications emphasize a shift toward simulation-based competency assessment, where tools differ from entertainment software primarily in their physical fidelity and diagnostic capabilities; while entertainment software prioritizes user experience and accessibility, professional training tools focus on the precise replication of physics and the measurement of specific safety-critical skills.

The situation is particularly interesting in Hungary, where the personification of this global trend is evident through two internationally prominent competitors. Norbert Michelisz has risen to the top of the world as a multiple international touring car champion (securing titles in the 2019 FIA WTCR and the 2023–2024 TCR World Tour), having built his career largely on simulator racing [4]. Similarly, Norbert Kiss, a seven-time FIA European Truck Champion [5], made a significant breakthrough via esports, where the online space opened the door to professional physical racing. These examples not only demonstrate the extent to which simulation can serve as a stepping stone to professional racing but also highlight the limited yet expandable potential of talent management in a cost-constrained environment.

[1] Web of Science query: TS=(esport* OR "e-sport*") AND PY=(2021-2025) AND DT=(Article) AND LA=(English) AND (WC=(Management) OR WC=(Business) OR WC=(Social Sciences Interdisciplinary) OR WC=(Sport Sciences))

[2] Scopus query: (TITLE-ABS-KEY (esport*) OR TITLE-ABS-KEY (e-sport*)) AND PUBYEAR > 2020 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "HEAL")) AND (LIMIT-TO (LANGUAGE , "English"))

From a theoretical perspective, the question remains: what exactly are the skills that can be developed in virtual space, and how do they translate into the physical world of motorsport? This represents what Ziv (2024) describes as an ecological and embodied approach to training [6]. In this framework, driving performance is the result of the constant interaction between the "driver-car unit" and the environment. Simulation environments allow for the continuous (re)calibration of higher-order affordance – specifically turn-ability, overtake-ability, and defend-ability – providing a representative learning design that bridges the gap between virtual and physical racetracks.

The choice of the topic is especially justified by the fact that the Hungarian National Automobile Sport Association (MNASZ), with its board resolution of 20 March 2025, established the Simulator Discipline, which was appointed by Norbert Kiss as its head [7] to promote simulator racing in Hungary.

The main objective of this study is, therefore, to explore how esports and simulation contribute to the identification of talent, the start-up of novice drivers and the continued development of active pilots already competing at a high-level. Our research focuses on experts who have both a background in esports and physical racing so they can shed light on the benefits and limitations of both spaces. The following sections present our interview results and discuss why simulator practice is becoming a cost-effective, mainstream tool in 21st-century motorsport.

2 Literature review

The following section provides a comprehensive overview of the theoretical foundations and existing research relevant to the intersection of motorsport, sports economics, and digital innovation. It explores the traditional revenue models of professional sports, the evolving role of sports marketing in the context of athlete branding, and the generational shifts in media consumption. Furthermore, this review situates simulation technology not merely as a gaming tool but as a validated instrument for competency development and fan engagement, supported by global professional initiatives and established ecological training theories.

2.1 Markets and revenue models as sources of sport

The financial sustainability of professional motorsport relies on a complex interplay of market segments. Understanding these revenue streams is essential for analyzing how simulation-based innovations offer cost-effective alternatives to traditional training and promotional methods.

The strategic role of sponsorship and athlete branding serves to deepen the relationship between sports and the corporate sector. András (2004) stresses that

sponsorship contributes to building both sport and corporate images [8]. In the digital age, this is increasingly tied to "athlete branding," where the driver becomes a central marketing asset. High-visibility "sports celebrities" act as primary vehicles for brand storytelling [9]. A prime contemporary example is Max Verstappen, who leverages his dual presence in Formula 1 and professional esports (e.g., Team Redline) to engage a broader demographic [10]. Beyond elite branding, Rahmati (2023) emphasizes that sponsorship resources allow clubs to invest in infrastructure and youth talent [11], while Cintyawati (2023) notes that in motorsport, these funds specifically improve competitiveness through technological development [12].

Ticket sales and consumer market engagement remain a core revenue pillar, as higher attendance yields gate receipts that clubs reinvest in infrastructure and development [8]. However, these streams are cyclically sensitive. According to Molnár and Csiszárik-Kocsir (2023), forecasting economic cycles is traditionally uncertain, posing risks to sport budgets [13]. Simulation offers a hedge against this volatility by providing lower-cost engagement and training alternatives during periods of economic constraint.

Media coverage as a catalyst for financing underpins the modern sports business model. Television and online broadcasting rights fees – shaped by audience size and media-market demand – are pivotal to financial sustainability [2]. Digital platforms allow events to reach wider audiences, contributing to rights revenues that are often used to fund post-school education [14, 15].

2.2 Generational patterns and sports marketing in youth education

Sports marketing and media play a key role in promoting sport, especially in the education of young athletes. The effectiveness of these strategies resonates differently across generations; as Garai-Fodor and Popovics (2023) point out, values serve as vital segmentation criteria for assessing corporate social responsibility in the digital era [16].

The synergy between esports and traditional sports allows for effective engagement of Generation Z, a cohort particularly sensitive to sustainability and digital privacy [17]. Digital platforms enable youth to connect with sporting opportunities seamlessly [18]. Furthermore, Palau-Saumell et al. (2021) suggest that marketing campaigns emphasizing teamwork and strategic thinking foster engagement [19], while Garai-Fodor and Huszák (2024) conclude that successful educational outreach must align with the individual values of Generation Z to promote a conscious and sustainable lifestyle [20].

2.3 Simulation technologies: Technical development and professional application

To understand the transferability of skills, it is necessary to examine how simulation software is used across professional levels. Beyond pure entertainment, F1 teams increasingly rely on high-fidelity simulators to optimize technical developments and race strategies. These tools allow engineers to fine-tune vehicle dynamics, aerodynamics, and suspension setups to gain a competitive advantage [21]. Furthermore, integrating artificial intelligence and machine learning into simulators provides additional benefits for faster data analysis and the training of novices [22]. These precise tools, used by teams for vehicle development and data-driven decision-making [23], represent the technological frontier of skill acquisition.

The practical application of these professional-grade tools in talent management is exemplified by the FIA Rally Star program [24]. This global initiative uses home-based simulators as the first stage of a professional selection funnel, proving that virtual platforms can effectively lower financial barriers and identify elite talent, such as Romet Jürgenson, who transitioned from a simulator final to becoming a Junior WRC Champion [25].

2.4 The role of esports in fan engagement: Opportunities and challenges

According to the 2021 Global F1 Fan Survey, esports plays a crucial role in engagement, with over 51% of fans regularly playing motorsport-specific games [1]. However, these results should be treated with caution. As Jakar and Carr (2022) suggest, the 2021 data reflects a period when most races were held behind closed gates, pushing fans toward digital alternatives [26]. While the "Drive to Survive" series significantly boosted popularity among younger audiences, it remains difficult to isolate exactly how much esports alone contributed to this growth versus the combined impact of multiple digital engagement strategies .

2.5 Theoretical framework for competence transfer

The integration of simulators into professional racing is grounded in Ziv's (2024) ecological and embodied approach [6]. This framework suggests that driving performance results from the constant interaction between the "driver-car unit" and the environment. Simulators provide a "representative learning design," allowing for the continuous recalibration of higher-order affordances – such as turn-ability, overtake-ability, and defend-ability. By providing a safe and repeatable environment for these interactions, simulation serves as a bridge between cognitive skill development and physical racetrack performance.

3 Methodology

The aim of this qualitative research is to investigate the links between motorsport and esports, in particular, whether esports can contribute to the discovery of talented young people and the development of motorsport drivers and their related skills. Given the traditionally high entry costs and technical requirements of motorsport, esports, particularly simulator racing, can offer an alternative platform where talented drivers can develop and demonstrate their skills. This research aims to understand how esports can support these two processes. In addition, the research will focus on how esports can be used to promote motorsport and the differences and similarities between esports software and games.

3.1 The subject of the qualitative research

Our qualitative research involved online, semi-structured interviews with selected experts. The sessions were recorded on video, and verbatim text transcripts were subsequently prepared for analysis. The interviews allowed the participants to express their views on the relationship between esports and real motorsport, as well as the role of simulators in driver training, along with pre-defined themes. Although the main questions and topics were pre-defined, the interviewees were free to move within these themes, providing the opportunity to gain deeper insights and explore personal perspectives.

The main research questions are: 1) How relevant is the role of esports in motorsport, especially for the development of athletes? 2) How can a simulator background contribute to the selection of drivers and their development early in their careers? 3) How can esports be used by currently active drivers for development or fitness purposes? 4) Where is the line between esports and gaming, and to what extent is realism important in esports software? 5) What barriers to athlete competence development in physical motorsport can esports help overcome?

The interview transcripts were processed using thematic and content analysis methods, which provided the opportunity to identify key patterns and contexts. The coding process was conducted in the original language (Hungarian) using Atlas.ti software to ensure the integrity of the professional terminology. This approach allowed us to gain a comprehensive picture of how experts interpret the relationship between esports and motorsport, and what factors influence the role of esports in the world of physical sport.

Although quantitative data collection was also carried out to assess attitudes towards motoring games, esports software, and physical racing, this paper focuses specifically on qualitative research findings. The analysis of the quantitative data will be presented in a forthcoming paper.

3.2 Selection of experts

The main criterion for the selection of the experts was to include individuals with significant professional experience in both esports and physical motorsport (purposive expert sampling). The following people have been selected as experts:

Norbert Michelisz is one of Hungary's most prominent touring-car drivers, and his career trajectory is closely linked to esports. Success in high-level sim-racing attracted the attention of Zengő Motorsport, facilitating his transition to professional competition. After progressing to the FIA World Touring Car Championship (WTCC), he secured the FIA World Touring Car Cup (WTCR) drivers' title in 2019.

Since the interview, he has added two TCR World Tour crowns (2023, 2024), bringing his total of international touring-car championships to three. Michelisz systematically applies his simulator-acquired skills in real-world racing and is a Formula 1 television analyst [4].

Norbert Kiss is a truck driver who started his career in the world of esports. Thanks to his esports background, he caught the attention of ProEx Motorsport, which gave him the opportunity to showcase his skills in real motorsport. He started his career racing touring cars and later moved into truck racing, where he has enjoyed a highly successful career.

Kiss competes in the highest-level FIA truck racing series, the European Championship. At the time of the interview, he had mathematically secured his fourth championship title but had not yet been officially declared the winner. He has since been recognised as a seven-time FIA European Truck Champion [5]. Throughout his racing career, he has successfully applied his experience in esports to real-world racing, showing continuous improvement that has made him one of the most influential figures in the sport. He also plays an active role in the promotion of motorsport, regularly appearing on F1 broadcasts as a commentator, sharing his expertise and racing experience.

Ákos Bognár is an IT journalist and founder of the Hyp-R Zone simulator portal. He has actively promoted the synergy between motorsport and esports through organized race meetings and public exhibitions, including displaying an F1 demo car during the 2020 Hungarian Grand Prix.

3.3 Data Analysis and Visualization

To ensure methodological rigor, the thematic analysis followed the logic of Braun and Clarke (2006)[27], involving familiarization, initial coding, and theme development within the Atlas.ti environment. This process resulted in a conceptual hierarchy of themes (Figure 1), which visualizes the relationship between the

identified driver competencies, cost factors, and the crossover between virtual and physical motorsport.

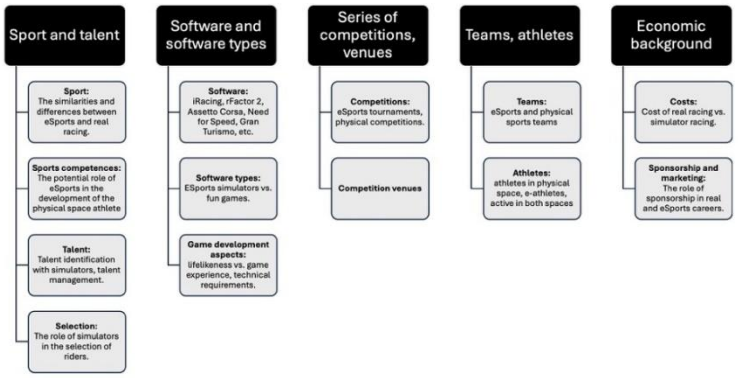

Figure 1.
Key themes identified during the interviews and their hierarchy in the context of physical motorsport and esports. (Source: Own ed.)

A word cloud (Figure 2) was generated as a visual supplement to the thematic analysis. This visualization was produced directly by Atlas.ti based on the frequency of software-specific mentions within the interview transcripts. The word cloud specifically contains only the names of software programs mentioned by the respondents. To add a diagnostic dimension, software deemed by the experts as suitable for professional esports was manually highlighted in inverse colors during the post-processing phase.

3.4 Research limitations

A major limitation of the research is the small number of interviewees, which makes it difficult to generalise the results. In the authors' view, for the research to be effective, it is necessary to involve experts who are successful in esports but who have also achieved significant results in physical motorsport. However, as the potential for this kind of conscious competence development has only recently become known to racing drivers, there are currently many young drivers who, although they have come from esports into the world of physical racing, are still too early in their careers to reach the level of success set by the authors. It is not uncommon to hear of successful adult drivers who are still active and successful who came from the world of esports, or some who are still esportsing today, but these individuals are less available for expert interviews. For this reason, it should be considered a fortunate coincidence that two drivers are available in Hungary who have been selected from esports to physical motorsport and are also competing

successfully in the top racing series of their respective categories. Due to the personal nature of the interviews, the answers were based on individual experiences, which may introduce subjective elements into the research. While qualitative methodology has the advantage of providing deeper insights, this may be at the expense of broad generalisability.

4 Results

The following section presents the findings derived from the thematic analysis of the expert interviews conducted with Norbert Michelisz, Norbert Kiss, and Ákos Bognár. The analysis, performed using Atlas.ti, identified several recurring themes regarding the integration of simulation into professional motorsport careers. The results are structured to reflect the relationship between virtual and physical racing, the technical requirements of professional-grade software, and the socio-economic advantages of simulation-based training. To provide an immediate overview of the experts' stances, the primary thematic codes and their corresponding insights are summarized in Table 1.

Table 1
Summary of key thematic perspectives identified in the expert interviews.

Theme / Code	**Norbert Michelisz**	**Norbert Kiss**	**Ákos Bognár**
Talent Selection	Early screening tool; identifies raw speed.	Assesses discipline and adaptability under pressure.	Lowers financial barriers for community entry.
Skill Transfer	Focus on reflexes and track familiarization.	Unlimited practice of starts and high-stress scenarios.	Cognitive development through community competition.
Realism Threshold	Real grip and G-forces are irreplaceable.	"There is no level where simulation is useless."	Technical fidelity (telemetry) is key for training.
Esports vs. Gaming	Determined by the purpose of use (training vs. fun).	Defined by the existence of strict rules and stewards.	Community structure and organized competition.

4.1 The relationship between active competition and esports

The drivers interviewed in the qualitative research, Norbert Michelisz and Norbert Kiss, shared different perspectives on the relationship between simulator racing and active racing. Norbert Michelisz said that in the early stages of his career, sim racing

played a prominent role in developing his driving techniques and getting to know the tracks well. However, as he gained more and more real-world racing experience, the importance of simulators for him gradually diminished, and he now only plays esports occasionally, which is why he doesn't consider himself an active e-athlete. According to Michelisz, the real-life experience is much more complex, and simulators cannot fully reproduce these finer details.

On the other hand, Norbert Kiss, who remains active in esports, stressed that simulators continue to play a key role in his development as a competitor, not only in refining technical skills but also in developing reflexes and decision making abilities. Kiss highlighted that simulators provide an opportunity for drivers to practice in safe conditions in various competitive situations and to continuously improve their performance. In his opinion, esports is an important tool beyond real racing, as it gives the opportunity to test new strategies and prepare for unexpected situations. To back this up, Max Verstappen, while fighting for his first Formula 1 world title with Lewis Hamilton at the end of the 2021 season, regularly used simulators, even between the season-ending races. According to Norbert Kiss, "there is no level at which simulation is useless," as this practice helps drivers prepare and manage race situations even under the greatest pressure.

Asked how he would differentiate between gaming and esports, Norbert Kiss explained that the line between the two becomes clear only when a driver enters his first organised race, one that is no longer merely an open public lobby. In his view, such open lobbies remain in the realm of casual gaming, as there are often no rules and no stewards to oversee participant conduct. Even so, Kiss notes that open races can offer valuable lessons – for instance, in coping with deliberately aggressive opponents.

By contrast, once a competitor participates in an organised championship with strict regulations and a panel of stewards, the context changes entirely. Systematic preparation becomes essential, including dedicated qualifying practice, race-day preparation, and fine-tuning of the car setup. According to Kiss, when a fixed calendar is established and drivers prepare methodically for each event, the activity crosses the threshold from gaming to sport.

4.2. Software suitable for esports and its impact

A central theme of the research involved identifying the software best suited for professional competency development. The experts reached a strict consensus on three primary platforms: iRacing, rFactor 2, and Assetto Corsa (see Figure 2) . These tools were distinguished by their high physical fidelity and the quality of their competitive communities. A comprehensive breakdown of the software mentions and their professional suitability is provided in Table A1 in the Appendix.

Norbert Michelisz added that software such as Need for Speed or Gran Turismo belong in the category of games rather than realistic simulators, as they compromise between lifelikeness and gameplay to reach a wider audience. "The game experience is not necessarily good if the driving is lifelike," said Michelisz, referring to the fact that developers often design games to make them more enjoyable, even if this is at the expense of lifelikeness.

Norbert Kiss explained that less lifelike games, such as Gran Turismo or Forza Horizon, are popular with the average gamer because they offer a quick hit and a fun gaming experience. In contrast, more realistic simulators such as iRacing require more commitment and dedication, as well as higher entry costs, as iRacing, for example, is subscription-based and each track and car must be purchased separately. Kiss pointed out that "iRacing requires a very high-level of commitment to get involved" and that serious racers often choose this software because of the community's high quality and professional racing.

Conversely, more fun, less realistic games such as Need for Speed or Gran Turismo are less suited to developing the skills needed to succeed in esports. According to Norbert Kiss, these games are more for entertainment and do not provide enough technical and tactical challenges for the drivers.

Figure 2.
Diagram of the "word cloud" of the software mentioned in the interviews
The size of the texts reflects the frequency of mention of the software in the in-depth interviews with the experts. Software that the experts considered particularly suitable for esports is highlighted in inverse colour. (Source: Own ed.)

4.3. The pathway to physical racing: Talent identification

Norbert Michelisz and Norbert Kiss stressed the importance of starting simulator and karting early to make it in professional motorsport. They both noted that

combining simulators and karting can be particularly effective for young drivers to acquire the basic skills and experience needed for a successful career.

Norbert Michelisz explained that simulators are an excellent way to discover talent early and use them as an initial screening tool, especially for drivers who do not yet have significant real-world racing experience. "The earlier someone is in their career, the more the simulator can help," said Michelisz, pointing out that the simulator can be a perfect tool in an initial selection process. However, as a driver spends more and more time on the real track, the role of the simulator gradually takes a back seat, and the results on track become decisive.

Michelisz shared his experience of a championship organised in 2020, where drivers with simulator experience but no real-world racing experience were selected in a multi-round series of races. The best drivers in the virtual championship were allowed to drive real race cars, and the best were selected to have the chance to test more serious race cars, such as TCR cars. "Quite frankly, the difficulty for us was also in finding the financial background for such a selection alone," Michelisz added, referring to the fact that the cost of talent management is a significant challenge.

According to Norbert Kiss, simulation is an excellent tool for identifying talented young people, but in real racing, other aspects are important. He stressed that not only does the raw speed count, but also the driver's attitude, discipline and behaviour during the race. He said that "if you have two kids who are, say, equally fast, but one crashes every other race and the other finishes every race, the second is the one I would dare to give the keys to a real race car to". Norbert Kiss stressed that adaptability is key in both simulator and real racing. In real racing, the drivers who perform better are those who can do it quickly with fewer laps and don't require thousands of laps of practice to perform well.

4.4. Cost-effectiveness and the removal of quantitative constraints

Norbert Kiss pointed out that one of the biggest advantages of simulator driving is the almost unlimited practice possibilities. Unlike in real racing, where financial and logistical constraints determine the amount of practice, simulators give competitors the opportunity to practice as much as they want, whenever they want. Kiss stressed that sim racing also gives drivers the opportunity to practice critical elements of races, such as starts, which are limited in real races.

Norbert Michelisz said that in the early stages of his career, simulators helped him a lot, especially in terms of reflexes and learning the tracks, but added that with experience, drivers rely less and less on simulators because "once you have done a lot of real kilometres on the track, the simulator [...] is not exactly reality". However, Michelisz stressed that practising race situations, even in online championships, is

still useful because "they make very, very similar decisions in race situations, in virtual space, as those drivers make in real life".

Norbert Kiss explained in detail that a real racing career requires a substantial financial background. As an example, he mentioned that participation in a Swift Cup Europe championship, including racing equipment and car rental, can cost up to €13,000 - €26,000 / year. He pointed out that without the support of parents or sponsors, it is almost impossible to cover these costs, and in many cases, only those young people with a significant financial background get the chance to compete. In contrast, the cost-effectiveness of simulator racing offers a particularly important opportunity for talented competitors with limited financial resources, as the running costs of simulators are a fraction of the cost of real racing.

Simulator racing also gives drivers the opportunity to accumulate vast amounts of race kilometres, which would be almost impossible to achieve in real life. "In the simulator, you can accumulate as many race kilometres in six months as a real driver does in a whole career," added Kiss.

4.5. Mental preparation and psychological resilience

During the interview, Norbert Kiss stressed that simulator training plays a key role not only in developing technical skills but also in preparing the drivers mentally. According to Norbert Kiss, this constant challenge and surpassing oneself are essential to enabling competitors to cope with the stress of real-life competitions and situations requiring sudden decisions.

Kiss also highlighted that simulation allows competitors to model race conditions that rarely occur in real life but require high mental preparation. Examples include dealing with unexpected situations or situations arising from competitors' unexpected behaviour, such as overtaking in uncommon situations. These exercises strengthen the drivers' technical skills and increase their psychological resilience, which is essential for a successful racing career.

5 Summary and Conclusions

The integration of simulation into professional motorsport represents a fundamental shift in how athletic competencies are developed and validated. This study explored the multidimensional role of esports, focusing on its capacity for talent identification, cost-effective training, and psychological conditioning. The following sections provide a synthesized overview of the findings, their practical and theoretical implications, and the strategic importance of organized simulation programs.

5.1 Summary of Findings

Based on the conclusions drawn from the interviews and the qualitative analysis, the answers to the research questions are summarised below:

1) How relevant is the role of esports in motorsport, in particular for the development of athletes? Qualitative findings and interviewees' feedback show that esports' relevance is increasing. It offers a training and development platform that, with the highest level of realism provided by the use of appropriate software, can effectively support competitors in developing their track awareness, reflexes, and strategic decision making.

2) How can a simulator background contribute to the selection of drivers and their development early in their careers? Interviewees agreed that the cost of esports, which is orders of magnitude lower than competing in physical space, and the possibility of unlimited practice could be a breakthrough, especially in talent management. Qualitative interviews show that young people coming from sim racing can cost-effectively acquire basic skills, such as car handling and solving racing situations, that are an important starting point for moving on to the world of physical racing.

3) How can esports be used by currently active drivers for development or to keep in shape? The in-depth interviews show that esports - especially sim racing - can be helpful for active drivers in three-ways: (1) Practice race situations: starts, overtaking situations, and defending can be modelled in a safer, more cost-effective way than in real life. (2) Mental preparation: playful, realistic virtual situations help maintain reflexes and quick decision making in stressful situations. (3) Track familiarisation feature: Some drivers (especially beginners or those in a new venue) have found that the simulator can increase their knowledge of the track, helping them prepare for the start. At the same time, Norbert Kiss and Norbert Michelisz stressed that "learning the track" is less decisive for experienced drivers, because real conditions and subtle differences (e.g. grip, temperature, banking) can only be truly experienced by being directly on the track.

4) Where is the line between esports and gaming, and to what extent is realism critical in esports software? Based on the in-depth interviews, it is not necessarily the realistic model of the software that determines whether we are talking about a "game" or „esports”, but rather the organisation and regulation of the competitive environment. While an open race, immediately accessible to everyone, has no strict rules, no stewards and only automatic penalties, participation is more like fun, a casual game. In contrast, esports are where there is a strict set of rules, official stewards and standards of sportsmanship, and where competitors prepare for races with regular training (practice, timing, set-up).

At the same time, drivers (e.g. Kiss, Norbert) acknowledge that realistic physical models - such as tyre grip, damage or weather changes - can be important in making

sim racing a "game experience" but a developmental, sporting experience. Even in highly realistic platforms (e.g. iRacing), not all real-world factors are simulated (e.g. dynamic rain or specific environmental effects), so the likeness to reality will never be 100%. Nevertheless, the most significant difference is the organised, sporting environment: it would be useless to have a physically detailed platform without well-defined rules and systematic preparation, which would be more like a game than a sport.

5) What barriers to athlete competence development in physical motorsport can esports help overcome? Responses indicate that high costs (e.g. track rental, car maintenance, spare parts), limited training time and physical risk are the main barriers to traditional motorsport. However, esports allow athletes to do all this at a fraction of the cost, at any time and in any number of repetitions. In addition, sim racing supports mental preparation and the development of adaptive skills, allowing these competences to be built up more quickly and safely, before or in addition to physical motorsport.

The research results indicate that simulation has evolved from a recreational activity into a critical professional training platform, effectively supporting track awareness, reflexes, and strategic decision making. The study confirms that the inherent cost-effectiveness of virtual environments makes them an ideal screening tool for early-career talent identification, allowing for the assessment of raw speed and procedural discipline before significant financial commitment is required. Furthermore, professional pilots usee these tools to model complex race scenarios and maintain cognitive sharpness, effectively bridging the gap between gaming and organized sport through a rigorous regulatory framework. By removing the quantitative constraints of traditional motorsport – such as logistical risks and high infrastructure costs – simulation provides a scalable and safe environment for continuous competency development.

5.2 Implications for Young Drivers and Active Competitors

The study results show that both esports and consumer-level sim-racing software (such as iRacing and rFactor 2) play an important role in engaging the younger generation and preparing active competitors. These tools provide an accessible platform for young talent to gain insight into motorsports at a lower cost, allowing them to learn the basics of driving techniques and familiarize themselves with various track characteristics.

However, the benefits are not limited to youth. For active competitors, simulation has become an essential tool for performance optimization and risk mitigation. The research suggests that these tools help competitors prepare for unexpected situations requiring quick decision making and improve performance in stressful conditions. This dual role – supporting both junior and active drivers – demonstrates that

simulation is now an indispensable component of the modern motorsport career path.

5.3 Practical Programmes and Use Cases: FIA Rally Star and Professional Paradigms

The FIA Rally Star program provides a definitive "proof of concept" for virtual-to-real career pathways [24]. The program's structured four-step funnel – from at-home competitions to the Junior WRC series – proves that simulation-acquired skills are directly transferable to elite professional rallying. This is evidenced by the success of Romet Jürgenson, who transitioned from a simulator final to becoming a Junior WRC Champion [25].

Furthermore, the "dual-athlete" model exemplified by Max Verstappen represents a paradigm shift in professional standards. His achievement in winning both an F1 Grand Prix and an elite esports race in a single weekend underscores the role of simulation in maintaining a constant competitive edge [10]. However, as noted in the results, this integration requires institutionalized discipline to balance digital engagement with physical recovery, as professional team interventions regarding simulator usage during race weekends indicate a growing need for "digital load management" in elite sports [28, 29].

5.4 Theoretical Implications: Gal Ziv's Ecological Approach

The scientific conclusion of this study provides empirical validation for Ziv's (2024) ecological and embodied approach to training. The findings suggest that the "driver-car unit" theory is applicable to virtual environments, where simulators provide a "representative learning design" for the continuous recalibration of higher-order affordances (turn-ability, overtake-ability, and defend-ability) [6]. The experts involved in this study confirmed that the cognitive decision making processes in virtual space are nearly identical to those on a real track, justifying the use of simulation as a theoretically sound tool for ecological skill acquisition and adaptive learning in safety-critical environments.

5.5 Practical Recommendations and Future Research Directions

While the current research focused on elite "crossover" experts to establish a baseline for professional simulation usage, the findings highlight a crucial shift in sport marketing and consumption. A recognized limitation of the current expert pool is that while a significant number of crossover athletes are already emerging in junior categories such as Formula 2, Formula 3, and Formula 4, their current age and career stage made them unavailable for the in-depth expert interview phase of

this study. The selection of established champions like Michelisz and Kiss was therefore necessary to validate long-term career impact.

Future research should prioritize investigating the role of esports and video games as strategic marketing tools in promoting motorsport to Generation Z and Alpha. It is essential to explore whether these digital platforms effectively foster long-term brand loyalty and increase the popularity of physical racing among "digital-native" cohorts. Additionally, as the current generation of F2, F3, and F4 crossover athletes reach professional maturity, a longitudinal analysis will be required to quantify the long-term impact of virtual training on career longevity. Finally, the institutionalization of the "Simulator Discipline" by the MNASZ in 2025 (MNASZ, 2025) provides a necessary institutional framework for future quantitative assessments regarding the impact of formalized virtual pathways on national talent production and fan engagement.

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Appendix

Table A1

Frequency of software mentions and expert consensus on professional esports suitability.

Software Name	Mentions (Frequency)	Suitable for Esports (Expert Consensus)
iRacing	32	Yes
Need for Speed	15	No
Gran Turismo	15	No
rFactor 2	14	Yes
Assetto Corsa	13	Yes
F1 (Series)	11	No
Forza Motorsport / Horizon	8	No
DiRT Rally	6	No
Project Cars	4	No
Grand Prix Legends	4	No
Grand Prix (Microprose)	4	No
CSR Racing	4	No
WRC	3	No
Live for Speed	3	No
Real Racing	2	No
RaceRoom	2	No
Nascar Heat	1	No