



UNIVERSIDADE
PORTUGALENSE

**Using Augmented Reality/ Virtual Reality for Client Product
Demonstration and Engagement at Simoldes**

Project Report submitted by

Ikram Hammou | 50773

Master's in Marketing and Digital Business



UNIVERSIDADE
PORTUGALENSE

DEPARTAMENTO
ECONOMIA E GESTÃO

Supervisor:
Professor Cláudia Carvalho

June 2025

Table of Contents

Acknowledgments.....	4
Abstract.....	5
List of Tables and Figures.....	6
List of Abbreviations.....	7
1. Introduction.....	8
2. Literature Review.....	12
2.1. Introduction.....	12
2.2. The History of Augmented Reality and Virtual Reality	12
2.3. Augmented Reality/Virtual Reality in B2B Marketing.....	14
2.4. Key Applications of Augmented Reality / Virtual Reality in B2B Marketing	16
2.5. Challenges in Implementing Augmented Reality/Virtual Reality in B2B Marketing.....	18
2.6. Examples in Manufacturing and Innovation.....	22
2.7.Challenges in Implementing Augmented Reality / Virtual Reality.....	24
2.8. Conclusions.....	26
3. Company Overview	30
3.1. Introduction.....	30
3.2. Simoldes: Business Areas and Market Position.....	30
3.3. Relevance of Augmented Reality/Virtual Reality for Simoldes.....	40
3.3.1. The Need for Digital Transformation in Manufacturing.....	40
3.3.2. Strategic Applications of Augmented Reality/Virtual Reality in Simoldes Operations.....	43
3.4. Summary.....	45
4. Methodology.....	47
4.1. Introduction.....	47
4.2. Research Design and Approach.....	47
4.3. Specific Objectives	48
4.4. Data Collection Methods.....	50
4.5. Summary.....	53
5. Project Development.....	54

5.1. Introduction.....	54
5.2. Data Analysis.....	54
5.3. Augmented Reality/Virtual Reality Concept and Design.....	56
5.4. Integration with Existing Platforms.....	62
5.5. Pilot Testing.....	64
5.6. Summary.....	66
6. Conclusion.....	67
References	70
Web Sources.....	74
Supplementary Sources.....	75
Annex-Interview Script with Simoldes Marketing Director.....	76

Acknowledgments

Reaching this stage in my academic journey has been anything but easy, and as I reflect on the challenges I've faced, I am filled with gratitude for the people who have supported me every step of the way.

First and foremost, I extend my deepest appreciation to my supervisor, Professor Cláudia Carvalho, whose guidance, patience, and invaluable insights have been instrumental in shaping this project. She has been more than just a supervisor she has been a true gem, offering encouragement, wisdom, and a steady commitment to my growth. Without a doubt, she is the best teacher I have encountered in my entire academic career, and I feel incredibly fortunate to have had her guidance throughout this journey.

I would also like to express my heartfelt thanks to Dr. Sónia Leite, Director of Marketing at Simoldes, for her generosity in sharing her knowledge and industry perspectives. Despite her busy schedule, she welcomed us to Simoldes in Oliveira de Azeméis, taking the time to ensure our visit was insightful and valuable. Her willingness to spare time for us and her dedication to fostering learning have greatly enriched my understanding of the industry.

To my close friends, who have been my pillars of strength, thank you for standing by me through the long nights, the moments of doubt, and the victories big and small. Your encouragement has meant more than words can express.

Above all, to my beloved parents, whose sacrifices, love, and endless belief in me have been the driving force behind my achievements. I know how much I have endured to reach this level, but I also know that without your constant support, I wouldn't be here today. For every prayer, every word of reassurance, and every lesson in perseverance, I am eternally grateful.

This accomplishment is not mine alone it belongs to all of you.

Abstract

In an increasingly digitalized business landscape, companies must find innovative ways to engage with their clients and enhance the customer experience. This study explores the integration of Augmented Reality (AR) and Virtual Reality (VR) in B2B marketing, focusing on how these technologies can revolutionize product demonstrations and client interactions. By analyzing industry trends and best practices, this research aims to provide strategic insights for businesses looking to adopt AR/VR as a competitive advantage.

This project takes Simoldes, a leader in the manufacturing sector, as a case study. Given its strong position in the automotive industry and interest in diversification, the research examines how AR/VR can be leveraged to showcase complex products and manufacturing capabilities, improve client engagement, and facilitate international expansion. The study is based on publicly available data and existing literature, identifying key opportunities and challenges in implementing these technologies within a B2B framework.

The final part of this report gives a general conclusion by bringing together the main results and offering useful suggestions for companies like Simoldes that want to use AR/VR. The research shows that it is important to match these technologies with the company's goals, make sure they are easy to use, and start with small tests before full use. With a good plan and focus on the user, AR/VR can help improve client communication, explain complex products more clearly, and support growth in the digital business world.

Keywords: Simoldes, Augmented Reality, Virtual Reality, B2B (Business-to-Business) Marketing, Client Engagement, Digital Transformation.

List of Tables and Figures

Table 1. Summary of AR/VR Implementations in B2B Marketing.....	21
Table 2. AR/VR Implementations in Manufacturing.....	26
Table 3. Comparison Table: WebAR vs. VR Development.....	59
Table 4. AR/VR Must-Haves	63
Figure 1. Exterior view of Simoldes Aços, located in Oliveira de Azeméis, Portugal.	32
Figure 2. Entrance of MDA, a division of the Simoldes Group located in Oliveira de Azeméis, Portugal.	32
Figure 3. Interior view of Simoldes Aços in Oliveira de Azeméis, Portugal.	33
Figure 4. Interior view of the Tryout Center at Simoldes located in Oliveira de Azeméis, Portugal.	34
Figure 5. Map from Simoldes official website showing red dots highlighting global presence of the company.	35
Figure 6. The Simoldes Logo.....	39
Figure 7. Welcome Interface	60
Figure 8. Virtual Showroom	60
Figure 9. 3D Product Viewer and Customization Panel	61
Figure 10. Feedback and Request Form	61
Figure 11. Visual Concept for AR/VR Pilot Testing.....	65

List of Abbreviations

Abbreviation	Meaning
AI	Artificial Intelligence
AR	Augmented Reality
B2B	Business-to-Business
CAD	Computer-Aided Design
CRM	Customer Relationship Management
ELM	Elaboration Likelihood Model
IoT	Internet of Things
KPIs	Key Performance Indicators
MRO	Maintenance, Repair, and Overhaul
PLM	Product Lifecycle Management
R&D	Research and Development
ROI	Return on Investment
SMEs	Small and Medium-sized Enterprises
TAM	Technology Acceptance Model
UX	User Experience
VR	Virtual Reality
WebAR	Web-based Augmented Reality
WebGL	Web Graphics Library
WebXR	Web Extended Reality

1. Introduction

The integration of Augmented Reality (AR) and Virtual Reality (VR) is transforming B2B marketing, particularly in the manufacturing sector, by improving client engagement, product visualization, and operational efficiency. These technologies, initially developed for gaming, are now enhancing industrial processes by reducing costs, improving efficiency, and offering immersive experiences that reshape production methods (Masood & Egger, 2019). AR and VR offer strategic solutions for international expansion and sector diversification, enhancing product interaction, minimizing travel needs, and providing a competitive edge (Boyd & Koles, 2019).

AR and VR are crucial in product demonstrations, customer engagement, and prototyping. They allow businesses to create interactive presentations and develop and modify 3D models efficiently, reducing costs (Boyd & Koles, 2019). These technologies also improve employee training by offering immersive, risk-free environments, which has been shown to enhance learning outcomes and safety (Guo et al., 2020). In maintenance and quality control, AR overlays digital information onto machinery, assisting technicians, while VR allows remote diagnostics, reducing travel costs and accelerating the sales cycle (Palmarini et al., 2018; Wang et al., 2016). AR and VR also enable remote collaboration, streamlining decision-making processes (Mütterlein, 2018).

Despite their benefits, the implementation of AR and VR in manufacturing and B2B marketing requires significant investment and can be complex due to resistance from employees (Aromaa et al., 2018). However, their potential to drive innovation and efficiency remains substantial. For Simoldes, leveraging AR and VR could strengthen its leadership in the automotive industry, enhancing productivity and customer engagement. The next section will explore Simoldes current position and the broader industry landscape (Masood & Egger, 2019).

The objective of this project is to explore how AR and VR technologies can be effectively integrated into Simoldes operations to enhance client engagement, improve product visualization, and support the company's digital transformation efforts. Simoldes, a global leader in automotive manufacturing, faces unique challenges in a competitive and fast-paced industry. The company's expansion into international markets and its commitment to innovation and sustainability make it an ideal candidate for the adoption of AR and VR technologies. These technologies align with Simoldes strategic goals, offering solutions to

improve operational efficiency, reduce costs, and enhance customer interactions. By focusing on Simoldes, this report aims to provide a practical roadmap for integrating AR and VR into a manufacturing context, addressing both the opportunities and challenges associated with these technologies.

The choice of Simoldes as the focus of this research is driven by its prominent position in the automotive manufacturing industry and its ongoing efforts to innovate and adapt to new technological trends. As a company that operates globally, Simoldes faces the challenge of maintaining effective communication and engagement with clients across different regions. AR and VR offer innovative solutions to these challenges, enabling remote collaboration, immersive product demonstrations, and efficient training programs. By examining how Simoldes can leverage these technologies, this report seeks to contribute to the broader understanding of AR and VR applications in B2B marketing and manufacturing.

Methodologically, this research relies on a combination of literature review, case studies and practical analysis. Given the relatively recent emergence of AR and VR in industrial applications, there is a notable lack of extensive research on their implementation in manufacturing, particularly in the context of B2B marketing. This report aims to fill this gap by providing a comprehensive analysis of how AR and VR can be integrated into Simoldes operations, drawing on existing case studies from other industries and applying these insights to the automotive manufacturing sector. The research will also explore the challenges of implementing AR and VR, including the high initial costs, technical complexities, and the need for employee training and adaptation.

Overall, this report looks at how AR and VR can be used in Simoldes operations to solve key business problems and improve client engagement. By focusing on a major automotive manufacturer, the research offers useful ideas and suggestions that could apply to other companies in the industry. The lack of research on this topic makes this study important, as it adds to the growing knowledge about using AR and VR in B2B marketing and manufacturing. With a clear approach, this report aims to provide a plan for Simoldes and other companies to use these technologies to drive innovation and growth in a competitive market.

More precisely the primary goal of this research is to explore how Augmented Reality (AR) and Virtual Reality (VR) technologies can be effectively integrated into Simoldes operations to enhance client engagement, improve product visualization, and support the

company's digital transformation efforts. By leveraging these advanced technologies, Simoldes aims to strengthen its position as a leader in the automotive manufacturing industry and maintain its competitive edge in a rapidly evolving global market. This research will focus on identifying practical and scalable ways to implement AR and VR solutions that align with Simoldes strategic goals, operational needs, and commitment to innovation and sustainability. The study's methodology (Section 4) will address five specific research objectives to systematically guide the integration of AR and VR technologies into Simoldes operations:

1. Assess Simoldes current challenges in client engagement and product demonstration across its global operations.
2. Develop an AR/VR-based concept tailored to Simoldes needs, focusing on enhancing the visualization of complex molds and automotive components.
3. Evaluate the feasibility of implementing AR/VR in terms of compatibility, usability, and scalability, considering Simoldes presence in multiple countries.
4. Define an integration strategy that aligns with Simoldes existing platforms and workflows, ensuring seamless adoption across different divisions.
5. Design a pilot test to measure AR/VR's impact on B2B marketing effectiveness, focusing on key metrics such as client engagement, design refinement efficiency, and potential cost savings.

The project is structured into six chapters, each addressing a key aspect of AR and VR integration in Simoldes operations. This first chapter provides an introduction to the topic, outlining the importance of AR and VR in B2B marketing and manufacturing, and setting the stage for the research objectives. The second chapter delves into the literature review, examining the role of AR and VR in B2B marketing and presenting case studies from other manufacturing companies that have successfully implemented these technologies. The third chapter offers a detailed overview of Simoldes, including its business areas, market position, and the relevance of AR and VR for the company. The fourth chapter outlines the methodology, detailing the research design and data collection methods used in this study. The fifth chapter focuses on project development, presenting an AR/VR concept tailored to Simoldes needs, discussing integration strategies, and proposing a pilot test to measure the impact of these technologies. Finally, the sixth chapter concludes the report by summarizing the findings and

providing recommendations for Simoldes on how to effectively adopt AR and VR technologies to enhance its competitive edge in the automotive manufacturing industry.

2. Literature Review

2.1.Introduction

This chapter provides a comprehensive analysis of the role, applications, and challenges of Augmented Reality (AR) and Virtual Reality (VR) in Business-to-Business (B2B) marketing. It is structured into several sections to guide the reader through both theoretical and practical perspectives. Section 2.2 introduces the historical background of AR and VR, setting the foundation for understanding their evolution. Section 2.3 focuses on how these technologies are used in B2B marketing, explaining their value and potential impact. Section 2.4 highlights the key applications of AR/VR, such as product visualization, virtual showrooms, training, and remote collaboration. Section 2.5 discusses the challenges companies may face when trying to adopt these technologies. Section 2.6 presents real-world examples from the manufacturing industry, showing how AR/VR has been applied in innovative ways. Section 2.7 expands on additional implementation challenges, including technical and organizational issues. Finally, Section 2.8 summarizes the main insights from the literature and reflects on the potential of AR and VR to transform B2B marketing practices.

AR and VR have emerged as powerful tools in B2B marketing, reshaping how companies engage with clients, showcase products, and convey complex concepts. In B2B settings, where decision-making often involves multiple stakeholders and long sales cycles, AR/VR offer an innovative approach to enhance customer interactions and streamline processes (Flavián et al., 2023). Research indicates that companies leveraging AR/VR experience improved lead generation, reduced sales cycles, and enhanced brand image (Losheniuk et al., 2023). These technologies enable businesses to create immersive and interactive experiences that go beyond traditional marketing methods, fostering deeper connections with clients (Wiederhold, 2020). Moreover, AR/VR facilitate remote collaboration, virtual product demonstrations, and personalized training, all of which contribute to improved customer satisfaction and stronger client relationships (Boyd & Koles, 2019).

2.2.The History of Augmented Reality (AR) and Virtual Reality (VR)

The history of Augmented Reality (AR) and Virtual Reality (VR) spans several decades, with their origins dating back to the 1960s. One of the earliest milestones in AR was achieved in 1968 when Ivan Sutherland developed the first AR headset, known as "The Sword of

Damocles" (Marr, 2021). This groundbreaking device was capable of displaying computer-generated graphics, laying the foundation for future AR technologies. Around the same time, the concept of VR began to take shape with Morton Heilig's invention of the Sensorama in 1962 (Sivarethinamohan, 2023). The Sensorama provided users with a multi-sensory cinematic experience, marking an important step in the evolution of immersive technologies.

During the 1970s, AR found practical applications in military training, particularly in the U.S. Air Force, where it was used for simulation-based training programs (Cipresso et al., 2018). The 1980s witnessed significant advancements in VR, most notably with the introduction of the DataGlove by VPL Research in 1985 (Tas, 2024). This innovative device allowed users to interact with virtual objects, enhancing the potential for immersive experiences. The 1990s saw the first attempts to commercialize VR, with products like SEGA's VR headset in 1991 and Nintendo's Virtual Boy in 1995 (Gupta & Choudhary, 2022). However, these early efforts faced technical limitations and were not widely adopted. Meanwhile, AR research during this period focused on wearable devices and marker-based tracking systems, which laid the groundwork for future developments (International Journal of Research Publication and Reviews, 2023).

The early 2000s brought rapid progress in both AR and VR technologies. VR benefited from advancements in display technology, tracking systems, and input devices, making it more accessible and functional (Sivarethinamohan, 2023). Similarly, AR saw the development of markerless tracking systems, which expanded its potential applications (Tas, 2024). The 2010s marked a turning point for both fields, as consumer-grade VR headsets like the Oculus Rift and HTC Vive were introduced, bringing immersive experiences to the general public (Gupta & Choudhary, 2022). AR also gained widespread recognition during this decade, particularly through mobile platforms. A notable example is the global success of the mobile game Pokémon Go in 2016, which demonstrated the potential of AR to engage users in novel ways (Marr, 2021).

Today, AR and VR technologies continue to evolve and are being applied across various fields, including healthcare, education, entertainment, and industry (Cipresso et al., 2018). Ongoing research and development promise to further expand their capabilities, opening up new possibilities for innovation (International Journal of Research Publication and Reviews, 2023). As these technologies advance, they are expected to play an increasingly significant role in shaping the future of human-computer interaction and digital experiences (Tas, 2024).

2.3. AR/VR in B2B Marketing: A Comprehensive Analysis of Applications, Impact, and Future Trends

AR and VR have emerged as transformative tools in B2B marketing, offering innovative ways to engage clients, showcase products, and simplify complex processes. This section explores how AR/VR addresses key challenges in B2B marketing, the benefits it delivers, and the theoretical frameworks that support its adoption.

B2B marketing encounters distinctive challenges that AR/VR solutions strategically address:

- **Complexity of Products and Services:** Many B2B offerings are highly technical. AR/VR allows for interactive, 3D visualizations that simplify complex concepts and provide a more intuitive understanding of products (Poushneh & Vasquez-Parraga, 2017).
- **Engagement in a Digital World:** As B2B buyers increasingly rely on digital channels, AR/VR provides a unique way to stand out and capture attention in a competitive market (Scholz & Duffy, 2018).
- **Cost-Effective Demonstrations:** Virtual demonstrations using AR/VR reduce logistical costs while providing an immersive experience that closely mirrors physical interactions (Jeong et al., 2016).
- **Personalization at Scale:** These technologies enable tailored experiences for different clients, addressing specific needs without requiring multiple physical prototypes (Nicholson et al., 2017).

As a result, several studies have shown that AR/VR brings clear advantages to B2B marketing, especially in helping companies respond to these challenges more effectively:

- **Enhanced Product Visualization:** AR/VR allows potential clients to interact with virtual prototypes, improving comprehension of complex products (Poushneh & Vasquez-Parraga, 2017).
- **Improved Customer Engagement:** By creating immersive experiences, AR/VR maintains client attention more effectively than traditional methods (Scholz & Duffy, 2018).

- **Data-Driven Insights:** AR/VR interactions provide valuable data on customer behavior, enabling more targeted marketing and sales strategies (Jeong et al., 2016).
- **Accelerated Sales Cycles:** More comprehensive product information and experiences help speed up decision-making and reduce the length of the sales cycle (Nicholson et al., 2017).

These practical benefits are supported by well-established theories that help explain why AR/VR is so effective in B2B marketing.

Three key models provide a solid foundation for understanding its impact:

- **Technology Acceptance Model (TAM):** This model suggests that perceived usefulness and ease of use influence AR/VR adoption in B2B marketing (Scholz & Duffy, 2018).
- **Elaboration Likelihood Model (ELM):** AR/VR enhances motivation and ability by making complex information more accessible and engaging for buyers (Poushneh & Vasquez-Parraga, 2017).
- **Experiential Marketing Theory:** AR/VR creates immersive experiences that leave a lasting impression on potential clients, increasing engagement and recall (Nicholson et al., 2017).

AR and VR have proven to be transformative tools in B2B marketing, addressing key challenges such as product complexity, engagement in a digital-first world, and high costs of traditional marketing methods. By offering enhanced product visualization, improved customer engagement, data-driven insights, and accelerated sales cycles, AR/VR delivers significant benefits that go beyond traditional approaches. Supported by theoretical frameworks like the Technology Acceptance Model (TAM), Elaboration Likelihood Model (ELM), and Experiential Marketing Theory (Nicholson et al., 2017), AR/VR adoption is driven by its perceived usefulness, ability to simplify complex information, and capacity to create memorable experiences. As businesses continue to embrace these technologies, AR/VR is poised to play an increasingly vital role in shaping the future of B2B marketing, fostering stronger client relationships and driving innovation.

2.4.Key Applications of AR/VR in B2B Marketing

This section explores the key applications of AR/VR in B2B marketing, including product visualization, brand storytelling, cost-effective demonstrations, training, and remote collaboration. These applications demonstrate how AR/VR is transforming B2B marketing by enhancing customer experiences and streamlining processes.

○ *Improving Product Visualization and Virtual Prototyping*

Many B2B products are highly complex, making it difficult for customers to understand their features from static images or descriptions. AR enables businesses to create 3D models accessible via smartphones, tablets, or AR glasses, while VR allows customers to experience the product in a simulated environment. For example, in aerospace, Boeing and Airbus use VR to provide virtual tours of aircraft interiors, enabling clients to explore designs without visiting a physical showroom (Jeong et al., 2016).

○ *Creating Engaging and Immersive Brand Storytelling*

B2B marketing often requires rational decision-making, but engaging storytelling remains an effective strategy. AR/VR enhances brand storytelling by making it interactive and memorable. For instance, construction companies use AR to overlay digital blueprints onto sites, helping stakeholders visualize projects before completion (Shin & Dunston, 2008). Logistics firms like DHL use VR to provide virtual warehouse tours, showcasing efficiency and operational excellence (Arora et al., 2010).

○ *Cost-Effective Product Demonstrations and Virtual Showrooms*

In B2B industries, product demonstrations are crucial but can be expensive and logistically challenging. AR/VR enables virtual showrooms and product demonstrations accessible from anywhere, allowing potential clients to explore offerings without requiring a physical presence. In the automotive sector, Volvo uses VR for virtual test drives, showcasing vehicle features without a showroom visit (Jeong et al., 2016).

- *Enhancing Training and Customer Support*

Training employees and customers using traditional methods can be time-consuming and costly. VR simulations allow employees to practice in a risk-free virtual environment, while AR provides real-time guidance. For instance, Medtronic uses VR to train surgeons in complex procedures, allowing them to gain experience before performing real surgeries (Nicholson et al., 2017). General Electric employs AR to assist technicians with real-time step-by-step instructions during repairs (Syed et al., 2020).

- *Facilitating Remote Collaboration and Design*

B2B projects often require collaboration between teams across different locations. AR/VR facilitates remote collaboration by enabling teams to work together on designs and prototypes in real time. For example, Ford employs VR for collaborative vehicle model design, allowing engineers to identify issues and make improvements before creating physical prototypes (D'Souza et al., 2016).

The applications of AR and VR in B2B marketing are vast and transformative, offering innovative solutions to long-standing challenges. From improving product visualization and creating immersive brand storytelling to enabling cost-effective demonstrations, enhancing training, and facilitating remote collaboration, AR/VR is reshaping how businesses engage with clients and streamline operations. These technologies not only enhance customer experiences but also drive efficiency, reduce costs, and foster stronger client relationships. As AR/VR continues to evolve, its applications in B2B marketing will expand, further solidifying its role as a critical tool for innovation and growth in the industry.

Beyond practical applications, AR/VR technologies also influence how B2B buyers think, feel, and make decisions.

This section examines how AR/VR influences B2B buyer behavior, including decision-making, emotional engagement, and long-term relationships. By providing interactive and personalized experiences, AR/VR helps buyers feel more confident and connected to brands.

Research shows that AR and VR can help buyers feel more confident and make better decisions by providing interactive experiences (Javornik, 2016). For example, VR product demonstrations can help customers better understand complex products, making the decision process faster. At the same time, AR allows customers to see products in their own space, which makes them feel more certain about their purchase (Poushneh & Vasquez-Parraga, 2017).

Additionally, personalized AR/VR experiences help companies connect with clients on a deeper level, building trust and engagement. While many believe that B2B buyers only focus on rational aspects like price and product specifications, emotions also play a key role in creating long-term business relationships (Flavián et al., 2023). By offering AR/VR experiences that match clients specific needs, businesses can create stronger connections and improve brand loyalty. Moreover, these technologies can also be useful in collaborative projects by making communication more transparent and helping both sides understand each other better.

2.5.Challenges in Implementing AR/VR in B2B Marketing

Although AR and VR technologies offer many advantages for B2B marketing, their implementation is not without challenges. These challenges can slow down adoption and limit the effectiveness of AR/VR solutions. This section discusses the main obstacles businesses face when integrating AR/VR into their marketing strategies, including high development costs, integration difficulties, and user adoption barriers.

- **High Development Costs**

One of the biggest challenges in adopting AR/VR is the high cost of development. Creating immersive AR/VR experiences requires a lot of money for hardware, software, and specialized skills. For example, developing custom VR applications or AR platforms often involves hiring expert developers, buying advanced equipment, and maintaining the technology over time. Small and medium-sized businesses (SMEs) may find these costs too high, making it difficult for them to compete with larger companies that have more resources (Scholz & Duffy, 2018). Additionally, AR/VR technologies need regular updates to stay relevant, which adds to the financial burden.

- **Integration Difficulties**

Another challenge is integrating AR/VR solutions with existing marketing strategies and IT systems. Many businesses use older systems that may not work well with AR/VR technologies, requiring significant changes or even complete replacements of their IT infrastructure. For example, integrating AR/VR into customer relationship management (CRM) systems or e-commerce platforms often requires custom APIs and middleware, which can be technically complex and expensive (Jeong et al., 2016). Moreover, AR/VR experiences need to work smoothly across different devices, such as smartphones, tablets, AR glasses, and VR headsets, which adds another layer of difficulty.

- **User Adoption Barriers**

A third challenge is ensuring that both internal teams and clients adopt AR/VR technologies. Since AR/VR is still relatively new, many users may not be familiar or comfortable with these tools. Employees and clients may need extensive training to use AR/VR applications effectively, which can take time and money. Resistance to change is also common, as some stakeholders may prefer traditional methods and see AR/VR as unnecessary or too complicated (Nicholson et al., 2017). Additionally, the design of AR/VR applications is very important. If the user experience (UX) is poor, users may become frustrated and stop using the technology, reducing its potential benefits.

While AR and VR have great potential to transform B2B marketing, businesses must overcome significant challenges to implement these technologies successfully. High development costs, integration difficulties, and user adoption barriers can slow down adoption and limit the effectiveness of AR/VR solutions. However, with careful planning, investment in training, and a focus on user-friendly design, businesses can address these challenges and fully benefit from AR/VR to improve customer engagement, streamline operations, and drive growth.

Looking to the future, AR and VR will become even more important in B2B marketing. The integration of Artificial Intelligence (AI) with Augmented Reality (AR) and Virtual Reality (VR) is expected to significantly enhance B2B marketing by offering more personalized and

adaptive experiences. AI-driven AR/VR applications enable businesses to analyze user interactions in real time and tailor immersive content to individual preferences, leading to higher engagement and more effective marketing strategies (Okorie et al., 2024).

Many companies are incorporating AR/VR technologies into their omnichannel marketing strategies to create more interactive and engaging customer journeys. These technologies help businesses merge physical and digital touchpoints, allowing for immersive product visualizations, virtual trade show experiences, and enhanced remote support. Studies suggest that AR/VR not only improves customer engagement but also delivers benefits in branding, relationship-building, cost efficiency, and sustainability (Wieland et al., 2024).

The rise of the Metaverse is another key development shaping the future of B2B marketing. This persistent virtual space enables businesses to interact with clients in innovative ways, such as hosting virtual product launches or delivering immersive training sessions. The shift toward virtual environments has the potential to reshape B2B relationships, fostering deeper engagement and collaboration (Dwivedi et al., 2022).

As AR/VR becomes more widespread in B2B marketing, companies must also address critical concerns related to data privacy and security. With the increasing reliance on immersive digital environments, it is crucial to implement strong data protection measures and comply with evolving privacy regulations to maintain trust and safeguard client information (Ning et al., 2024).

The future of AR/VR in B2B marketing looks very promising. With AI integration, the growth of the Metaverse, and omnichannel strategies, these technologies can create personalized and immersive experiences that improve customer engagement. However, businesses must also focus on data privacy and security to build trust and protect client information. By adopting these technologies and addressing their challenges, companies can stay competitive and innovative in the B2B market.

The table below shows the main ways AR and VR are used in B2B marketing. It includes the benefits, real-world examples, and references to support each application. This table helps to explain how AR/VR technologies are improving areas like product visualization, client

engagement, training, and collaboration. It also shows how these technologies are making B2B marketing more effective and innovative.

Table 1. Summary of AR/VR Implementations in B2B Marketing

Applications	Benefits	Examples	References
Product Visualization	Enhanced understanding, reduced need for physical samples, customization	Airbus virtual aircraft tours, Siemens AR-enhanced machinery diagnostics	Palmarini et al., 2018
Client Engagement	Improved information retention, emotional connection, active participation	Volvo virtual test drives, immersive brand storytelling	Poushneh & Vasquez-Parraga, 2017; Javornik, 2016
Cost-Effective Demonstrations	Reduced logistical costs, expanded reach, virtual showrooms	Virtual machinery presentations, remote product demonstrations	Boyd & Koles, 2019; Jeong et al., 2016
Training and Support	Risk-free learning environments, real-time customer guidance, enhanced skills	Medtronic surgical training simulations, GE remote assistance	Nicholson et al., 2017; Syed et al., 2020
Collaborative Design & Engineering	Improved efficiency, reduced errors, real-time feedback	Ford VR-based design collaborations, remote engineering sessions	D'Souza et al., 2016; Kumar et al., 2021

Source: Author's own elaboration

The table highlights how AR/VR is used in different industries to solve problems and improve marketing strategies. For example, Airbus uses VR for virtual aircraft tours, and Medtronic uses VR for training surgeons. These technologies help businesses save costs, improve communication, and create memorable experiences for clients.

2.6.Examples in Manufacturing and Innovation

In this section, some practical examples are shared to show how companies are using AR and VR in manufacturing. These examples were found during the literature review and help explain how well-known companies like Boeing, Siemens, Caterpillar, and Ford have applied these technologies in real situations. They show how AR/VR can improve training, maintenance, customer support, and design, and offer useful ideas that could also work for Simoldes.

- Boeing: Enhancing Training and Efficiency with VR

Boeing is a leader in using Virtual Reality (VR) technologies, especially for astronaut training and improving assembly line efficiency. By using VR, the company creates realistic simulations that allow trainees to practice complex and high-risk tasks in a safe and controlled environment. This helps improve their skills and prepares them for real-world challenges. For example, astronauts use VR to rehearse pre-flight checks, emergency procedures, and other critical tasks without any risk (Smith et al., 2018).

In addition to astronaut training, Boeing also uses VR to train assembly line workers. VR-based training programs have proven to be very effective, reducing training time and improving efficiency. Workers can practice assembling parts in a virtual environment, identify potential mistakes, and avoid errors in real-life operations (Gavish et al., 2015). This leads to smoother manufacturing processes and fewer mistakes.

Research shows that VR improves spatial awareness and procedural knowledge, which are crucial for complex manufacturing tasks (Luo et al., 2019). Through interactive 3D environments, trainees can better understand how different components fit together and improve their assembly and maintenance skills (Berg & Vance, 2017). VR also offers personalized training by adapting to each worker's learning style and skill level, providing feedback based on their performance (Makransky et al., 2019). This results in better training outcomes and a more skilled workforce.

- Siemens: AR-Driven Maintenance and On-Site Repairs

Siemens is a leader in using Augmented Reality (AR) technology in the manufacturing sector, especially for maintenance and repair tasks. One of their most important innovations is the Teamcenter-driven Maintenance, Repair, and Overhaul (MRO) system. This AR-based platform helps companies manage knowledge and improve maintenance activities throughout a product's lifecycle. By using AR, technicians can see digital information overlaid on physical equipment, which gives them real-time guidance for diagnostics and repairs. This reduces errors and speeds up task completion (Palmarini et al., 2018). The system is also user-friendly, so even new employees can perform complex maintenance tasks without needing extensive training.

In addition to the MRO system, Siemens has developed on-site repair solutions that combine mobile robotics with additive manufacturing (3D printing) technologies. This approach allows Siemens to repair critical components directly at the client's location, reducing downtime and improving customer satisfaction (Fraga-Lamas et al., 2018). For example, if a machine breaks down, Siemens can send a team with AR-guided robots to fix it on-site, avoiding the need to stop production. This has revolutionized maintenance processes, making them faster and more efficient.

- Caterpillar: Enhancing Customer Support with AR

Caterpillar has become a pioneer in using Augmented Reality (AR) to transform customer support in the heavy machinery sector. Their innovative AR remote assistance platform enables technicians to provide real-time guidance to customers during troubleshooting and repairs. By using AR, customers can see digital instructions overlaid on their machinery through smartphones, tablets, or AR glasses. This visual guidance makes it easier for customers to follow complex repair steps, improving accuracy and reducing errors (Porter & Heppelmann, 2017).

A major benefit of this AR system is its ability to reduce the need for on-site visits. Instead of sending technicians to every location, Caterpillar can now resolve many issues remotely. Customers receive step-by-step visual instructions, allowing them to fix problems quickly and minimize machinery downtime. This not only saves time and money but also enhances customer satisfaction by providing faster and more efficient support.

- Ford: Collaborative Design Using VR

Ford has taken a bold step into the future by integrating Virtual Reality (VR) into its design process. This innovative approach allows engineers and designers, even those working in different parts of the world, to collaborate on virtual prototypes of new vehicle models. Using VR headsets, teams can explore designs, test ideas, and identify potential problems—all before a single physical prototype is built (D'Souza & Lee, 2016). This virtual collaboration not only speeds up the design process but also reduces the risk of expensive mistakes.

The benefits of VR in Ford's design process are clear. First, it saves time and money by eliminating the need for multiple physical prototypes. Instead of building and testing physical models, teams can make changes in the virtual world, which is faster and more cost-effective. Second, VR reduces material waste, making the process more sustainable. Finally, VR improves teamwork by creating a shared virtual space where engineers and designers can work together as if they were in the same room. This has led to more creative solutions and better-quality designs.

2.7.Challenges in Implementing AR/VR

While AR and VR technologies offer promising benefits for manufacturing companies, their implementation is not always straightforward. Alongside the advantages, businesses must overcome several challenges to successfully integrate these innovations into their operations. High initial costs, technical complexities, and employee adaptation issues can all slow down the adoption process and impact the overall effectiveness of these technologies.

To successfully adopt AR and VR, Simoldes must take a thoughtful approach that weighs the potential benefits against the practical challenges of implementation. By anticipating these difficulties in advance, the company can make informed decisions, avoid unnecessary setbacks, and ensure a smooth transition toward these advanced digital tools. This section explores the main obstacles companies face when implementing AR and VR, highlighting key factors that Simoldes should consider before moving forward.

- **Substantial Initial Investment:**

Developing AR/VR solutions demands a considerable financial commitment for hardware, software, and specialized expertise. For many businesses, especially smaller ones, these upfront costs can be a major barrier to entry.

- **Complex Integration Processes:**

Integrating AR/VR systems with existing workflows and IT infrastructure can be technically demanding. Ensuring compatibility and seamless operation is essential to maximize the return on investment (ROI) and avoid disruptions.

- **Employee Adaptation and Training:**

For AR/VR to be effective, employees need to be properly trained to use these tools. Resistance to change or a lack of familiarity with the technology can slow down adoption and reduce its overall impact.

A recent study highlights the importance of aligning AR/VR technologies with current workflows to fully realize their potential (Mourtzis et al., 2020). Companies should also prioritize intuitive and user-friendly designs to encourage widespread acceptance among employees. For Simoldes, careful evaluation of cost-effectiveness, technical readiness, and employee willingness will be critical to ensure a smooth and successful integration of AR/VR solutions.

While AR and VR offer valuable opportunities, their implementation comes with challenges that cannot be overlooked. High costs, technical integration issues, and employee adaptation are key obstacles that Simoldes must address. A strategic approach that considers these factors will be essential to ensuring a smooth and effective adoption of these technologies.

The table below summarizes how leading manufacturing companies Boeing, Siemens, Caterpillar, and Ford are using Augmented Reality (AR) and Virtual Reality (VR) technologies to improve their operations. It highlights the key applications, benefits, and references for each case study. This summary provides a quick overview of how AR/VR is transforming the

manufacturing industry and offers insights that Companies can consider for their own implementation.

Table 2. AR/VR Implementations in Manufacturing

Companies	Applications	Benefits	References
Boeing	Training & Assembly	Reduced training time, Enhanced training Effectiveness	Bottani & Vignali, 2019; Masood & Egger, 2019
Siemens	Maintenance & Repair	Reduced downtime, Improved Efficiency	Fraga-Lamas et al., 2018; Palmarini et al., 2018
Caterpillar	Customer Support	Enhanced customer service	Porter & Heppelmann, 2017
Ford	Design	Improved collaboration, Reduced errors	D'Souza & Lee, 2016

Source: Author's own elaboration

The table highlights how AR/VR technologies are transforming manufacturing, from training and maintenance to customer support and design. These examples demonstrate the potential of AR/VR to improve efficiency, reduce costs, and enhance customer satisfaction, offering valuable insights for Simoldes.

2.8.Conclusions: The Transformative Power and Future of AR/VR in B2B

Marketing and Manufacturing

For Simoldes, integrating AR/VR technologies could deliver significant competitive advantages across multiple operations. VR would enhance training programs, reducing onboarding time and improving workforce productivity in complex manufacturing processes. AR could revolutionize maintenance operations by providing real-time guidance to technicians, speeding up repairs and minimizing errors. An AR-based remote support system would enable clients to troubleshoot mold issues with virtual assistance, improving satisfaction while reducing costly on-site visits. For product development, VR would allow engineers to collaboratively design and test virtual molds, identifying potential issues early and accelerating production cycles. Together, these applications would position Simoldes as an innovative

industry leader, improving efficiency, client relationships, and operational flexibility while reducing costs and development time.

Key Lessons For Simoldes: As industries worldwide embrace digital transformation, the integration of Augmented Reality (AR) and Virtual Reality (VR) has emerged as a game-changer in manufacturing. Companies such as Boeing, Siemens, Caterpillar, and Ford have successfully leveraged these technologies to optimize operations, enhance workforce training, and improve customer interactions. Given these advancements, it is crucial for Simoldes to explore how AR and VR can be strategically implemented to drive efficiency, innovation, and customer satisfaction. This section outlines key lessons from leading companies that Simoldes can adopt to maintain its competitive edge and enhance its industrial processes.

Here are the key lessons that Simoldes can apply:

- **Enhanced Training:**

AR and VR technologies can make training more effective by creating immersive and safe environments for employees. For example, workers can practice complex or risky tasks in a virtual setting, which helps them learn without the risks of real-world mistakes (Masood & Egger, 2019). Simoldes could use VR to train employees in mold manufacturing processes, allowing them to gain skills without the costs and risks of physical training.

- **Efficiency Gains:**

VR can also help reduce training time while improving worker performance. By simulating real-world scenarios, employees can learn faster and perform better on the job (Bottani & Vignali, 2019). For Simoldes, this could mean faster onboarding of new employees and more efficient assembly line operations.

- **Improved Maintenance:**

AR-based remote support and on-site repair solutions can minimize downtime and improve customer satisfaction. For instance, technicians can use AR glasses to get real-time guidance during repairs, reducing errors and speeding up the process (Palmarini et al., 2018). Simoldes could use AR to provide remote assistance to clients, helping them troubleshoot mold issues quickly and reducing the need for on-site visits.

- **Collaborative Innovation:**

VR allows teams to work together on complex designs, even if they are in different locations. By creating virtual prototypes, engineers can test ideas, identify issues, and make improvements in real-time (D'Souza & Lee, 2016). Simoldes could use VR to collaborate with clients on mold designs, reducing errors and speeding up the development process.

- **Customer Engagement:**

AR and VR can also improve how Simoldes interacts with its clients. For example, AR can be used to provide real-time support during troubleshooting, while VR can create interactive demonstrations of new products (Porter & Heppelmann, 2017). These technologies can make the client experience more engaging and satisfying, helping Simoldes build stronger relationships.

By strategically integrating AR and VR technologies, Simoldes can significantly enhance its training programs, improve operational efficiency, streamline maintenance procedures, foster collaborative innovation, and elevate customer engagement. Embracing these technologies will enable Simoldes to gain a competitive edge, drive innovation, and build stronger, more meaningful client relationships, positioning the company for long-term success in the evolving manufacturing landscape.

In conclusion augmented Reality (AR) and Virtual Reality (VR) are revolutionizing both Business-to-Business (B2B) marketing and manufacturing, providing businesses with immersive and interactive tools to enhance client engagement, streamline operations, and drive innovation. These technologies offer businesses a way to engage customers beyond traditional methods by presenting virtual showrooms, interactive product demonstrations, and personalized training modules. As a result, companies can present unique value propositions that capture the attention of potential clients and provide a deeper understanding of complex products and services (Wieland et al., 2024). This approach not only improves customer interactions but also fosters stronger and more meaningful relationships.

In the manufacturing sector, companies such as Boeing, Siemens, Caterpillar, and Ford have already shown how AR and VR can improve training, maintenance, design, and customer

support, leading to significant time savings, reduced costs, and enhanced customer satisfaction. For Simoldes, these case studies offer valuable insights. By leveraging AR and VR, the company could enhance employee training, accelerate problem-solving, improve operational efficiency, and provide more effective communication with clients. However, as with any new technology, there are challenges to consider, including high initial costs, the need for employee adoption, and the integration of these technologies into existing processes.

To maximize the potential of AR and VR, strategic planning, user-centered design, and continuous innovation are essential. Aligning AR/VR initiatives with business objectives and ensuring seamless integration with existing marketing strategies are key success factors. Creating user-friendly, intuitive experiences that meet the specific needs of the target audience is equally important (Wieland et al., 2024). In addition, the future of AR/VR in B2B marketing looks promising with the ongoing development of AI-driven solutions that can personalize and optimize immersive experiences in real-time. Leveraging data analytics and machine learning will allow businesses to gain valuable insights into buyer behavior and tailor their AR/VR efforts accordingly.

As AR/VR technologies become more accessible and affordable, they are set to become integral components of the B2B marketing landscape. For Simoldes, if these challenges can be overcome, the integration of AR and VR could significantly enhance its competitive edge, boost growth, and position the company as a leader in the mold manufacturing industry. By adopting these technologies, Simoldes can not only improve its operations and client services but also drive innovation and establish itself as a forward-thinking, industry-leading company (Adawiyah et al., 2024).

3. Company Overview

3.1.Introduction

This chapter provides a comprehensive overview of Simoldes Group, focusing on its history, business areas, market position, and the relevance of emerging technologies like Augmented Reality (AR) and Virtual Reality (VR). It is divided into three main sections. Section 3.2 explores Simoldes evolution from a small mold-making workshop to a global leader in automotive components and tooling, highlighting its key business areas, competitive advantages, and market presence. Section 3.3 examines the potential applications of AR/VR technologies in Simoldes operations, including product design, manufacturing optimization, workforce training, and sustainability initiatives. Finally, Section 3.4 concludes by assessing the strategic value of AR/VR for Simoldes, considering how these technologies could foster future growth and innovation.

The integration of AR and VR is becoming increasingly relevant in the automotive industry, offering new opportunities to enhance various business operations. These technologies can significantly improve product development, streamline manufacturing processes, optimize workforce training, and strengthen customer interactions. As a key player in the automotive sector, Simoldes specializes in plastic components and molds, areas where AR/VR could drive innovation and operational efficiency. While there is no publicly available information confirming the company's current use of these technologies, industry trends suggest that AR/VR could support Simoldes in optimizing design and prototyping, increasing production accuracy, and advancing sustainability goals. This section explores how AR/VR could impact Simoldes operations and contribute to its strategic growth and competitive positioning.

3.2.Simoldes: Business Areas and Market Position

Simoldes, a prominent Portuguese company in the automotive industry, has grown from a small mold-making plant into a global leader in automotive components and tooling (Simoldes Group website)¹. Founded on November 30, 1959, by António Rodrigues in Oliveira de Azeméis, Portugal, the company started with an initial capital of just €200 (40,000 escudos at the

¹<https://www.simoldes.com/en/about-us-simoldes/> accessed on May 29, 2025

time) (Simoldes Group website). This humble beginning laid the foundation for what would become a global leader in automotive components and tooling.

The story of Simoldes is one of resilience, innovation, and strategic vision. António Rodrigues, the founder, was a visionary entrepreneur who recognized the potential of the mold-making industry in Portugal. With just €200, he established a small workshop that focused on producing high-quality molds for plastic components. This modest start was driven by Rodrigues' commitment to precision and excellence, which quickly earned the company a reputation for reliability and innovation (Simoldes Group website).

In 1963, Simoldes relocated its plant to expand operations, reflecting its growing success (Simoldes Group website). This move was a strategic decision to accommodate increasing demand and improve production capabilities. By 1966, after conducting extensive market research, the company implemented a precise marketing strategy, approaching potential customers through well-known brokers (Simoldes Group website). This approach was typical for businesses in the 1960s, as brokers provided access to international markets and helped small businesses like Simoldes establish a foothold in the global market.

Two years later, in 1968, Simoldes adopted a direct selling method, making its first direct sale in England (Simoldes Group website). This marked a significant shift in its business model, allowing the company to build stronger relationships with its customers and gain a deeper understanding of their needs. This shift also signaled Simoldes' growing confidence and capability to engage with clients independently.

A significant milestone came in 1974 when Simoldes built a new facility that remains operational today and is considered the company's "mother house" (Simoldes Group website). During this period, many global companies froze investments due to the economic recession triggered by the oil crisis. However, Simoldes Aços (the steel division) continued to invest in new equipment and experienced personnel, preparing itself for market demands and consolidating its image as a reliable and innovative mold maker (Simoldes Group website).



Figure 1. Exterior view of Simoldes Aços, located in Oliveira de Azeméis, Portugal.

Source: Author's own photograph

Simoldes Group operates in two main business areas, each contributing to its success in the global market:

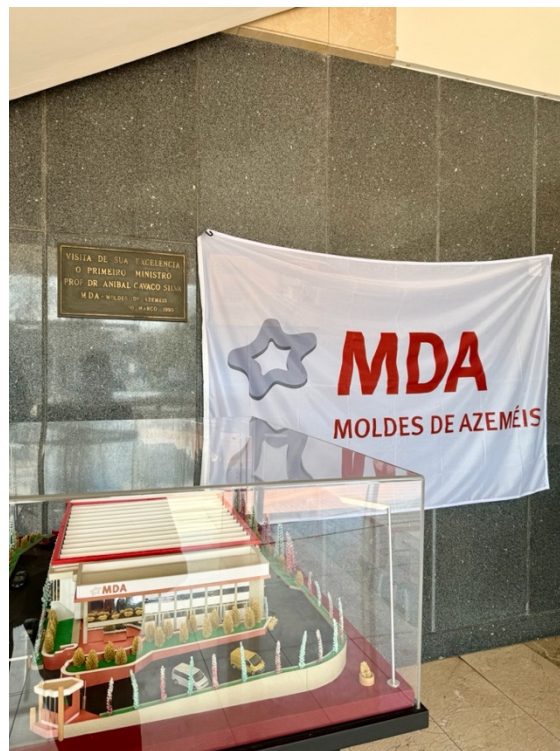


Figure 2. Entrance of MDA, a division of the Simoldes Group located in Oliveira de Azeméis, Portugal.

Source: Author's own photograph

Simoldes Tool Division specializes in the production of molds for large plastic components and exports to more than 30 countries (Simoldes Group website). It comprises several companies, including:

- **Simoldes Aços, SA:** Focuses on high-quality steel for mold production, ensuring durability and precision.
- **MDA², SA:** Specializes in mold design and engineering, offering customized solutions to meet client needs.
- **IMA³, SA:** Provides advanced machining and tooling solutions, leveraging cutting-edge technology to enhance production efficiency.
- **Simoldes Aços Brasil:** Expands the company's presence in South America, catering to the growing demand for high-quality molds in the region.
- **Mecamolde, SA:** Offers precision mold manufacturing, with a focus on complex geometries and high-performance materials.
- **IGM⁴, SA:** Focuses on innovation and advanced manufacturing techniques, including additive manufacturing and automation (Tools Division section of the website)⁵.



Figure 3. Interior view of Simoldes Aços in Oliveira de Azeméis, Portugal.

Source: Author's own photograph

² *MDA: Moldes de Azeméis*

³ *IMA: Indústria de Moldes de Azeméis*

⁴ *IGM: Indústria Global De Moldes*

⁵ <https://www.simoldes.com/en/tools/company-simoldes/> accessed on May 29, 2025

The Tool Division is known for its technical expertise and ability to deliver complex, high-precision molds. It plays a critical role in Simoldes vertically integrated business model, ensuring seamless coordination between mold production and plastic injection. This integration allows Simoldes to offer faster production cycles and immediate adjustments to molds, ensuring high-quality output and customer satisfaction (Tools Division section of the website).

Simoldes Plastic Division Established in 1980, the Plastic Division has become a prominent supplier in the automotive industry supply chain, specializing in the injection of plastic parts (Simoldes Group, Plastics Division⁶; AFIA, 2023). This division consists of eight companies around the world and generates the majority of the group's revenue (Simoldes Group, Plastics Division)⁶. It serves clients in the automotive, industrial, and consumer goods sectors, producing components such as dashboards, bumpers, and interior trims.

The Plastic Division's success lies in its ability to deliver high-quality, customized solutions while maintaining cost efficiency. Its global footprint allows it to serve clients in key markets, including Europe, South America, and Asia. The division is also known for its commitment to innovation, leveraging advanced technologies such as automation and additive manufacturing to enhance production processes and reduce lead times (Simoldes Group, Plastics Division)⁶.



Figure 4. Interior view of the Tryout Center at Simoldes located in Oliveira de Azeméis, Portugal.

Source: Author's own photograph

⁶<https://www.simoldes.com/en/plastics/empresa/> accessed on May 29, 2025

Simoldes Market Position and Global Presence shows it as a leading player in the automotive industry, particularly in Europe. The group generates revenues of approximately €400 million and employs more than 4,000 people worldwide (Simoldes Group, Plastics Division). Simoldes exports to over 30 countries, including Argentina, France, Germany, Spain, Sweden, Netherlands, United Kingdom, United States, and Turkey (Simoldes Group website).



Figure 5. Map from Simoldes official website showing red dots highlighting global presence of the company.

Source: retrieved from <https://www.simoldes.com>

The company has manufacturing plants in Portugal, Brazil, France, and Poland (Simoldes Group, Plastics Division). Additionally, Simoldes has expanded its facilities to Asia and Eastern Europe, following its customer's migration and market dynamics (Simoldes Group website). The group's international presence includes:

- **Portugal:** Multiple facilities.
- **Brazil:** Three companies (two in Curitiba and one in São Paulo).
- **Argentina:** One facility.
- **France:** Manufacturing plant.
- **Poland:** Manufacturing plant.
- **Morocco:** Facility.

- **Czech Republic:** Facility.
- **Germany:** Facility (Simoldes Group website; AFIA, 2023).

Simoldes Plastics has established three technical/commercial support offices in Spain, Germany, and France to provide better customer service (Simoldes Group, Plastics Division). These offices offer rapid after-sale services, including modifications, repairs, and maintenance, further strengthening client relationships.

Simoldes has built an impressive client portfolio in the automotive industry, including renowned brands such as:

- **Stellantis** (Citroën, Peugeot, DS Automobiles, Opel).
- **Renault Nissan Mitsubishi.**
- **Volkswagen Group** (Volkswagen, Audi, Porsche, Seat, Skoda).
- **BMW.**
- **Toyota.**
- **Scania.**
- **Mercedes-Benz** (Simoldes Group, Plastics Division; AFIA, 2023).

In the non-automotive sector, Simoldes serves clients such as Amtrol-Alpha, NEXX, Dorel, Haworth, Lennox International, Browning, Cotesi, DS Smith, Bodum, Hexagon, and Solaris Float (Simoldes Group, Plastics Division; AFIA, 2023). These partnerships highlight Simoldes versatility and ability to adapt to diverse industry needs.

Simoldes maintains market leadership through seven core differentiators that collectively enhance its value proposition:

- **Vertical Integration:** Simoldes integration between mold production and plastic injection within the same group sets it apart from competitors. This integration allows for faster production processes and immediate assistance if any adjustments are required in the molds (Simoldes Group, Plastics Division).
- **Technical Expertise:** The company has developed significant know-how in detecting problems and potential efficiencies in the mold-making process, creating a major source of competitive advantage (Simoldes Group, Plastics Division).

- **Customer Service:** Simoldes has established Advanced Customer Service (ACS) offices in key markets, providing commercial and technical support to major clients. These offices offer rapid after-sale services, including modifications, repairs, and maintenance (Simoldes Group, Plastics Division).
- **Global Reach:** With facilities in multiple countries, Simoldes can serve global customers efficiently, ensuring consistent product quality across different geographical areas (Simoldes Group, Plastics Division).
- **Skilled Workforce:** The company prioritizes having skilled employees with experience and academic training, particularly in the Tool Division (Simoldes Group, Plastics Division).
- **Client-Focused Approach:** Simoldes designs, creates, innovates, and produces with the goal of doing better and more sustainably every day, adding value to their clients supply chains (Simoldes Group, Plastics Division).
- **Innovation and Technology:** While not explicitly mentioned in the search results, it's worth noting that during a visit, it was observed that Simoldes has additive manufacturing capabilities in metal, showcasing their commitment to advanced manufacturing technologies (Universidade Católica Portuguesa, n.d.).

Simoldes is well-positioned to capitalize on four key areas of opportunity that will drive its future development and growth:

- ⇒ **Expansion into New Markets:** Simoldes has plans to continue its internationalization process, with potential expansions into Spain, Russia, and the Czech Republic (Simoldes Group, Plastics Division).
- ⇒ **Diversification:** While the automotive industry represents 90% of Simoldes revenues, there may be opportunities to expand into other sectors to reduce dependency on a single industry (Simoldes Group, Plastics Division).
- ⇒ **Sustainability Initiatives:** As sustainability becomes increasingly important in the automotive industry, Simoldes could focus on developing more eco-friendly manufacturing processes and products (Simoldes Group – Sustainability Report, 2023)⁷.

⁷https://www.simoldes.com/wp-content/uploads/2023/12/SIMOLDES_Relatorio2021_2022_AF_Digital_Dupla-1.pdf accessed on May 29, 2025

⇒ **Digital Transformation:** Investing in Industry 4.0 technologies and digital solutions could further enhance Simoldes competitive edge in the market (Simoldes Group, Plastics Division).

- Financial Performance and Investment

While detailed financial information is limited in the search results, it's noted that Simoldes has received private equity funding. The company's last reported funding was \$17.33 million, raised approximately three years ago (Simoldes Group, Plastics Division). This investment suggests confidence in Simoldes growth potential and market position.

- Manufacturing Philosophy

Simoldes prefers to build its own manufacturing plants rather than acquiring existing companies when entering new markets. This approach allows them to maintain consistency in their manufacturing processes, which they consider a major source of competitive advantage. By building homogeneous plants worldwide, Simoldes ensures that product quality remains consistent across different geographical areas, a crucial factor when serving global customers (Simoldes Group, Plastics Division).

- Research and Development

Simoldes places a strong emphasis on research and development (R&D), as evidenced by its ability to provide innovative solutions to clients and its adoption of advanced manufacturing techniques like additive manufacturing for metal components (Universidade Católica Portuguesa). The company's commitment to R&D is a key driver of its competitive advantage, enabling it to stay at the forefront of the automotive components and tooling industry. By investing in cutting-edge technologies and processes, Simoldes ensures that it can meet the evolving needs of its clients and maintain its position as a global leader in the market.

- Sustainability Initiatives

Simoldes has demonstrated a commitment to sustainability, as evidenced by their 2021-2022 Sustainability Report (Simoldes Group– Sustainability Report, 2023). The company views

sustainability as an exercise in transparency and continuous improvement. While specific details of their sustainability initiatives are not provided in the search results, this focus aligns with the growing importance of environmental responsibility in the automotive industry.



Figure 6. The Simoldes Logo

Source: retrieved from <https://www.simoldes.com>

The star in the Simoldes logo holds significant historical importance, representing the five first companies ever created by António Rodrigues, the founder of Simoldes. This detail, shared during a visit to the company, adds a personal touch to the company's branding and highlights Rodrigues' entrepreneurial spirit. The logo not only reflects the company's origins but also symbolizes its growth and evolution from a small mold-making workshop to a global leader in automotive components and tooling (Simoldes Group website).

- Additive Manufacturing in Metal

During a visit to Simoldes facilities, it was observed that the company has capabilities in additive manufacturing for metal components. This advanced manufacturing technique allows for the creation of complex geometries and can potentially reduce material waste and production time. While not mentioned in the search results, this capability demonstrates Simoldes' commitment to staying at the forefront of manufacturing technologies (Universidade Católica Portuguesa).

- Recent Challenges and Future Outlook

As of December 2024, Simoldes faced challenges due to the ongoing crisis in the automotive sector. The company expected a significant revenue drop in 2024, with projections showing a decrease of €100–150 million compared to the €700 million generated in 2023 (Simoldes

Group– Sustainability Report, 2023). This decline was attributed to dampened sales and orders for plastic parts and molds in the automotive industry.

Jorge Leitão, Simoldes Tools sales representative, acknowledged the potential for cutbacks among the company's workforce of over 6,000 employees. While cutbacks were not being implemented at the time, the company was exploring options to protect jobs and maintain operations.

The slowdown was particularly evident in the plastic parts injection business, which accounts for 95% of the unit's revenue from the automotive segment. Car manufacturers, grappling with reduced sales, cut back on orders, leading to reduced daily production volumes.

In spite of these challenges, Simoldes remains focused on growing its collaboration with car manufacturers. The company aims to provide turnkey engineering solutions that involve early-stage project involvement, adding value through innovation. However, these initiatives require time and stable market conditions to thrive.

As the automotive industry continues to struggle with declining sales and uncertainty, Simoldes is prioritizing prudent investment and job retention. The company remains hopeful for a turnaround but expects that challenges will persist through 2025 and beyond.

3.3.Relevance of Augmented Reality/Virtual Reality for Simoldes

3.3.1. The Need for Digital Transformation in Manufacturing

The manufacturing industry is changing fast, thanks to new technologies like artificial intelligence (AI), the Internet of Things (IoT), augmented reality (AR), and virtual reality (VR). These tools are part of what's called Industry 4.0, and they're helping companies work smarter, faster, and more efficiently. For example, AR and VR can improve how products are designed, reduce costs, and make quality control better (Masood & Egger, 2019).

For a company like Simoldes, which works in automotive manufacturing, using these technologies is essential to stay competitive. The world is more connected than ever, and customers expect better, faster, and more interactive experiences. AR and VR can help Simoldes meet these expectations by making it easier to show products, work with clients remotely, and improve how things are made.

Simoldes was founded in 1959 and has grown into one of the top companies in the automotive manufacturing industry. It specializes in making plastic injection molds and plastic parts, mostly for cars. With factories in Portugal, Brazil, France, and Poland, Simoldes is Europe's biggest mold maker.

Some of its biggest clients include well-known car brands like Stellantis (Citroën, Peugeot, Opel), Renault Nissan Mitsubishi, Volkswagen, BMW, and Mercedes-Benz. Working with these global companies means Simoldes needs to keep finding new ways to stay ahead and keep its clients happy.

However, as Simoldes grows and works with clients all over the world, it faces some challenges. One of the biggest is how to show its products effectively, especially when clients are far away. Traditional methods, like sending physical prototypes or using 2D drawings, don't always work well for complex products. This makes it harder for clients to understand what Simoldes can offer.

Another challenge is staying innovative and sustainable. Simoldes has a mission to “design, create, innovate, and produce better and more sustainably every day.” To meet this goal, the company needs to find new tools and technologies that can help it work smarter and reduce its environmental impact. (Simoldes Group website)¹.

AR (Augmented Reality) and VR (Virtual Reality) technologies are not just trendy tools they are powerful solutions that align perfectly with Simoldes strategic goals. As a global leader in automotive manufacturing, Simoldes faces unique challenges in a competitive and fast-paced industry. AR and VR offer innovative ways to address these challenges while supporting the company's mission to innovate, improve efficiency, and operate sustainably. Here's a deeper look at how these technologies can help:

- ***Better Product Visualization***

One of the biggest challenges in automotive manufacturing is explaining complex designs to clients. Traditional methods, like 2D drawings or physical prototypes, often fail to fully convey the intricacies of molds and car parts. AR and VR can transform this process by creating immersive, interactive 3D models.

For example, using VR, clients can "step inside" a virtual environment to explore a mold or component from every angle. AR, on the other hand, can overlay digital models onto real-world settings, allowing clients to see how a part fits into a larger assembly. This level of visualization helps clients understand the product better, reduces misunderstandings, and builds confidence in Simoldes capabilities.

- ***Improved Client Engagement***

In a globalized market, Simoldes works with clients spread across different countries and time zones. Traveling for in-person meetings or product demonstrations can be time-consuming and expensive. AR and VR offer a solution by enabling remote collaboration.

With these technologies, Simoldes can conduct virtual product demonstrations where clients can interact with digital models in real-time. Design meetings can also be held online, with engineers and clients working together in a shared virtual space. This not only saves time and money but also makes the process more flexible and convenient for clients. By offering these advanced tools, Simoldes can strengthen its relationships with clients and stand out as a forward-thinking partner.

- ***Faster and Cheaper Prototyping***

The traditional design and prototyping process can be slow and costly. Engineers often need to create multiple physical prototypes to test and refine a design, which takes time and resources. AR and VR can streamline this process by allowing engineers to create and test virtual prototypes.

In a virtual environment, engineers can simulate how a mold or component will perform under different conditions, identify potential issues, and make adjustments before moving to physical production. This reduces the number of physical prototypes needed, cuts down on material waste, and speeds up the time-to-market for new products. For Simoldes, this means greater efficiency and cost savings, which can be passed on to clients.

- *Sustainability*

Sustainability is a core part of Simoldes mission. The company is committed to reducing its environmental impact and finding ways to operate more sustainably. AR and VR support this goal in several ways.

First, by reducing the need for physical prototypes, these technologies help minimize material waste. Second, virtual meetings and demonstrations cut down on the need for travel, lowering the company's carbon footprint. Finally, digital tools enable more efficient use of resources, from energy to raw materials. By adopting AR and VR, Simoldes can demonstrate its commitment to sustainability while also improving its operations.

- *Competitive Advantage*

In a crowded market, companies need to differentiate themselves to stay ahead. AR and VR give Simoldes a competitive edge by offering clients a more modern, interactive, and efficient experience. These technologies show that Simoldes is not just keeping up with industry trends but leading the way in innovation.

For example, a client who can visualize a product in 3D or test it in a virtual environment is more likely to trust Simoldes expertise and choose them over competitors. This kind of cutting-edge service can help Simoldes win new business and retain existing clients.

3.3.2. Strategic Applications of AR/VR in Simoldes Operations

The integration of AR/VR technologies offers transformative potential across Simoldes value chain. These applications align with the company's strategic priorities in innovation, efficiency, and sustainability:

◇ **Enhanced Vehicle Design and Prototyping**

One of the primary applications of AR/VR in the automotive sector is product design and prototyping. These technologies allow companies to create digital models of new vehicle components before physical production, reducing development time and material waste (HQSoftware, 2024). For Simoldes, this could mean improving the design process for plastic components, ensuring precision, and identifying potential flaws before production. By

leveraging VR simulations, engineers could visualize and modify components in real time, minimizing costly revisions.

◇ **Optimized Manufacturing Processes**

The integration of AR in manufacturing environments enhances efficiency by providing workers with real-time guidance during assembly and production processes (HQSoftware, 2024). In the context of Simoldes, AR could assist technicians in complex molding and tooling operations by overlaying step-by-step instructions or highlighting specific areas for quality control. This would reduce human error, improve consistency in production, and potentially shorten lead times.

◇ **Advanced Training and Safety Simulations**

Employee training is another area where AR/VR technologies offer significant benefits. Traditional training methods often require hands-on experience, which can be time-consuming and resource-intensive. VR-based training programs create simulated environments where employees can practice operating machinery, assembling components, or handling emergency scenarios in a risk-free setting (HQSoftware, 2024). Simoldes could adopt such solutions to train its workforce on new manufacturing techniques, ensuring higher competency levels and adherence to safety protocols.

◇ **Innovation in Automotive Interiors**

Simoldes has demonstrated a commitment to innovation through projects such as FACS (Future Automotive Cockpit & Storage), which focuses on developing new interior architectures and storage solutions⁸. AR/VR can play a crucial role in the design phase by enabling designers and engineers to visualize different configurations, test ergonomics, and assess material compatibility before moving to physical prototypes. This could lead to more efficient product development and better alignment with industry demands.

⁸ <https://www.simoldes.com/en/innovation-plastics/facs-future-automotive-cockpit-storage/> accessed on May 29, 2025

◇ **Enhancing Customer Experience**

Although Simoldes operates primarily in a B2B environment, AR/VR could still play a role in strengthening customer engagement. Automotive manufacturers increasingly use these technologies to present interactive product showcases, allowing potential clients to explore components in a virtual setting (Sapien, 2025). Simoldes could utilize AR applications to demonstrate the features and benefits of its products in a more immersive way, enhancing client interactions and supporting sales efforts.

◇ **Sustainability and Waste Reduction**

Sustainability has become a central concern in the automotive industry, and AR/VR technologies contribute to more eco-friendly practices. By enabling virtual prototyping and reducing the reliance on physical samples, these tools help minimize material waste and energy consumption (Sapien, 2025). Simoldes, which has already outlined its sustainability efforts in its 2021-2022 Sustainability Report, could further align with these goals by incorporating AR/VR solutions in its design and production workflows.

3.4. Summary

Simoldes Group has grown from a small mold-making workshop in Oliveira de Azeméis, Portugal, into a global leader in automotive components and tooling. With its vertically integrated business model, the company specializes in mold production and plastic injection, catering to renowned automotive brands worldwide. Its commitment to innovation, technical expertise, and customer-focused solutions has solidified its market position, particularly in Europe.

Despite its strong foundation, Simoldes faces challenges due to the ongoing crisis in the automotive sector. To maintain stability, the company must carefully balance cost-cutting measures while staying committed to its long-term growth strategy and innovation. However, its resilience, diverse client portfolio, and focus on sustainability and advanced manufacturing technologies provide a solid path forward.

One key opportunity for Simoldes lies in the adoption of AR/VR technologies, which could significantly improve efficiency, enhance innovation, and support sustainability efforts. While no confirmed implementation exists within the company, industry trends suggest that AR/VR could help streamline design and prototyping, optimize manufacturing, improve workforce training, and enhance customer engagement. As the automotive industry continues to evolve, integrating AR/VR solutions may not just be an advantage but a strategic necessity for maintaining competitiveness.

Looking ahead, Simoldes strategic investments, adaptability, and commitment to sustainability will likely play a crucial role in its future growth and competitiveness in an ever-changing industry landscape. By embracing technological advancements and market shifts, the company is well-positioned to weather current challenges and emerge even stronger in the global automotive supply chain.

4. Methodology

4.1. Introduction

The methodology for this research is designed to explore how augmented reality (AR) and virtual reality (VR) technologies can enhance Simoldes client engagement and product demonstration processes. Given the complexity of Simoldes operations in the automotive sector, the study adopts a qualitative approach to gain deeper insights into the company's challenges, technological readiness, and the potential for adopting AR/VR solutions. This research combines both primary and secondary data to ensure a well-rounded understanding of the current landscape and to assess the feasibility of integrating AR/VR into Simoldes existing infrastructure.

This methodology chapter is divided into several important sections. Section 4.2, Research Design and Approach, explains the main strategy of the study and how the research was planned. Section 4.3, Specific Objectives, presents the main goals that the research aims to achieve. Section 4.4, Data Collection Methods, describes how information was gathered from both the company and external sources. Section 4.5, Conclusions, provides a summary of the results and reflects on what the research has shown.

4.2. Research Design and Approach

This research uses a qualitative and exploratory approach, which is appropriate because the topic involves a new and developing area using Augmented Reality (AR) and Virtual Reality (VR) in B2B marketing. Since the goal of this project is to better understand Simoldes current challenges in showing and explaining their products to clients, it is more helpful to collect detailed insights rather than only numbers or statistics.

A qualitative approach allows for deeper understanding of how Simoldes currently interacts with its clients, especially when presenting complex molds and automotive components. This type of research is useful when exploring people's experiences, opinions, and processes inside the company. It also helps to better understand the specific needs and limitations of the company before suggesting a solution.

As part of the research process, a visit to Simoldes facilities in person was conducted. During this visit, the Marketing Director, who kindly provided a lot of useful information about the company's marketing strategies, how they currently present their products, and the tools they

use to communicate with international clients. A guided tour of the production area was also included, which helped to see how their products are created and the challenges they face when explaining technical details to clients, especially across different countries and cultures. This visit provided a real-life perspective that significantly contributed to shaping the main goals of the project.

In addition to the qualitative input obtained during the company visit, the study also incorporates secondary data collection through desk research, which includes:

- Reviewing academic literature related to AR/VR in industrial marketing.
- Analyzing industry reports and white papers from consulting firms such as McKinsey, PwC, and Deloitte, focusing on the adoption of immersive technologies in manufacturing and B2B environments.
- Examining case studies of companies that have implemented AR/VR for client engagement, to identify best practices and avoid potential pitfalls.
- Reviewing public materials from Simoldes, including their website and digital presence, to understand how the brand currently communicates its offerings.

Moreover, a comprehensive technology review will be conducted to assess the suitability of current AR/VR platforms and software solutions, such as Unity, Unreal Engine, and Microsoft HoloLens. This evaluation will focus on their technical feasibility and interoperability with Simoldes existing digital infrastructure, including computer-aided design (CAD) systems and product lifecycle management (PLM) platforms.

By integrating primary qualitative insights with an extensive review of secondary sources, this methodological approach ensures that the project is both empirically grounded and strategically coherent with Simoldes operational context. Furthermore, it establishes a robust foundation for the development of a customized AR/VR solution that aligns with the company's specific industrial requirements and competitive positioning.

4.3. Specific Objectives

The objective of this project is to explore how AR and VR technologies can be effectively integrated into Simoldes operations to enhance client engagement, improve product visualization, and support the company's digital transformation efforts.

The primary objectives of this research are as follows:

Objective 1. Assess Simoldes current challenges in client engagement and product demonstration across its global operations.

This objective aims to conduct a comprehensive analysis of Simoldes existing marketing and sales approaches, identifying limitations in how the company presents its products to clients. The focus will be on understanding pain points related to communication, visualization, and interaction, especially in showcasing complex molds and automotive components. Additionally, this assessment will explore regional differences in client expectations and technological adoption across Simoldes international markets.

Objective 2. Develop an AR/VR-based concept tailored to Simoldes needs, focusing on enhancing the visualization of complex molds and automotive components.

Based on the identified challenges, this objective involves designing an AR/VR-based solution that enhances the way Simoldes demonstrates its products. The goal is to create an interactive, immersive experience that allows clients to engage with virtual prototypes, examine detailed product specifications, and better understand the functionality of automotive components. The concept will be tailored to Simoldes industry requirements, ensuring that it meets the company's unique needs in B2B marketing and client communication.

Objective 3. Evaluate the feasibility of implementing AR/VR in terms of compatibility, usability, and scalability, considering Simoldes presence in multiple countries.

A key aspect of this research is evaluating the feasibility of AR/VR implementation at Simoldes, focusing on compatibility, usability, and scalability. The study will examine the technological compatibility of AR/VR with Simoldes current digital ecosystem to determine whether the existing infrastructure can support integration. From a usability standpoint, the practicality and ease of use of AR/VR tools for employees and clients will be considered. Additionally, scalability will be a major focus, ensuring that any proposed solution can be deployed across Simoldes global operations, taking into account varying levels of technological readiness in different regions.

Objective 4. Define an integration strategy that aligns with Simoldes existing platforms and workflows, ensuring seamless adoption across different divisions.

This objective focuses on formulating a structured plan for incorporating AR/VR into Simoldes business processes without disrupting ongoing operations. The integration strategy will outline how AR/VR can complement existing digital tools, such as CAD software, product lifecycle management (PLM) systems, and client communication platforms. The strategy will also consider employee training requirements, potential resistance to new technology, and necessary modifications to existing workflows to facilitate smooth adoption.

Objective 5. Design a pilot test to measure AR/VR's impact on B2B marketing effectiveness, focusing on key metrics such as client engagement, design refinement efficiency, and potential cost savings.

To validate the effectiveness of AR/VR in a real-world scenario, a pilot test will be designed and proposed for implementation. This pilot will measure specific performance indicators, such as improvements in customer engagement, the efficiency of design visualization and refinement, and reductions in costs associated with physical prototyping and travel. The results of this pilot will provide data-driven insights into the technology's impact, guiding future decisions regarding full-scale deployment within Simoldes.

4.4.Data Collection Methods

This research adopts a mixed-method approach by integrating both primary and secondary data sources to ensure a comprehensive understanding of Simoldes current communication practices and its potential for integrating AR/VR technologies into its operations. This mix of methods helps provide a deeper and more balanced analysis by combining company insights with wider industry trends.

- Primary Data Collection

The primary data was obtained through a qualitative, semi-structured expert interview with the Marketing Director of Simoldes, conducted during an on-site company visit in February 2025. The interview was not limited to verbal responses but was complemented by a guided tour of the facilities, offering contextual understanding of the operational environment in which Simoldes functions. This immersive interaction provided key insights into the communication and visualization challenges the company faces when presenting its complex molds and automotive components particularly to international clients who are often unable to visit the production sites in person.

The qualitative approach to data collection was chosen to extract in-depth, nuanced perspectives directly from a decision-maker with hands-on knowledge of both the company's current challenges and its openness to innovation. This aligns with Creswell's (2014) and Kvale's (2007) assertions that qualitative methods are effective for uncovering subjective experiences, context-dependent insights, and organizational intentions. The flexible format of the interview allowed for the emergence of themes such as the limitations of 2D communication tools, the potential value of interactive visualization, and existing concerns about implementation and cost of immersive technologies.

- Secondary Data Collection

To enrich and validate the findings from the primary research, extensive secondary data collection was conducted. This included a systematic review of academic literature, industry whitepapers, and strategic outlook reports from respected consulting and research firms. Sources were selected based on their relevance, recency, and authority in the fields of industrial innovation, immersive technologies, and B2B marketing.

For instance, McKinsey's Technology Trends Outlook 2024 underscores immersive reality (AR/VR) as a transformative force in industrial environments, emphasizing its role in enhancing product visualization, workforce training, and remote collaboration (McKinsey & Company, 2024). These insights are particularly applicable to Simoldes, which seeks better ways to represent its technically complex products to clients worldwide.

Similarly, Deloitte's 2023 Manufacturing Industry Outlook identifies digital transformation including the integration of AR/VR as a key enabler of operational agility, improved customer experiences, and long-term competitiveness (Deloitte, 2023). These secondary sources not only reinforce the urgency for innovation at Simoldes but also offer evidence-based expectations for return on investment and implementation challenges in similar industrial contexts.

- Technology Review and Benchmarking

To support the feasibility analysis, a technology benchmarking review was also incorporated into the data collection process. This involved evaluating leading AR/VR platforms such as Unity, Unreal Engine, and Microsoft HoloLens. The evaluation focused on four key criteria:

- **Technical capabilities:** including 3D modeling, real-time rendering, and simulation realism
- **System integration:** compatibility with existing enterprise systems such as CAD (Computer-Aided Design) and PLM (Product Lifecycle Management)
- **User experience and accessibility:** the intuitiveness of the user interface and adaptability across skill levels
- **Scalability:** the platform's ability to support multi-site deployment across Simoldes global network

This review was grounded in technical documentation, vendor whitepapers, and real-world case studies, as suggested by Braun and Clarke's (2006) guidance on thematic analysis and synthesis of qualitative data. Particular attention was given to Microsoft HoloLens and Unreal Engine, which stood out due to their strong integration potential with industrial design tools and their immersive capabilities.

- Industry Trend Analysis

In parallel, an industry trend analysis was conducted to contextualize Simoldes situation within broader market developments. This involved identifying use cases where AR/VR technologies have been successfully adopted in B2B and manufacturing contexts, noting common implementation strategies, key obstacles, and measurable outcomes such as improved client engagement or reduced prototype development time.

Through reports from PwC, Deloitte, and McKinsey, this analysis sheds light on the growing adoption of immersive tools in automotive manufacturing and related sectors. It also provides benchmarks for evaluating the feasibility, scalability, and potential return on investment of AR/VR tools at Simoldes.

By combining firsthand qualitative insights from a key stakeholder within Simoldes with an in-depth review of secondary sources and a technical benchmarking of AR/VR platforms, this multi-faceted data collection strategy ensures a holistic and strategically aligned foundation for the project. This approach not only grounds the research in the operational realities of Simoldes but also ensures its relevance and applicability in the current technological and industrial landscape.

4.5.Summary

This project used a qualitative method to explore how AR/VR technologies could help Simoldes improve client communication and product presentation. The research included a company visit and a semi-structured interview with the Marketing Director, along with a tour of the production area. To support this, secondary data was collected by reviewing academic literature and industry reports. A technology review was also carried out to compare AR/VR tools like Microsoft HoloLens, Unity, and Unreal Engine. These tools were evaluated based on how well they fit with Simoldes current systems. This combination of real company insights and external research helped create a strong base for suggesting a solution that suits Simoldes needs and goals.

5. Project Development

5.1. Introduction

This chapter introduces the results of the research and the proposed AR/VR marketing solution developed for Simoldes, a B2B company in the automotive industry. This chapter builds on the previous findings and presents how immersive technologies can support product presentation and client engagement.

Section 5.2 presents the data analysis based on both primary and secondary data, highlighting the challenges Simoldes faces and the opportunities offered by AR/VR technologies. Section 5.3 explains the concept and design of the proposed AR/VR solution, showing how clients can interact with Simoldes products in a realistic and immersive environment. Section 5.4 focuses on how the solution can be integrated into Simoldes existing platforms, ensuring smooth compatibility and usability. Finally, Section 5.5 describes the pilot testing phase, which aims to test the platform, gather user feedback, and make improvements before wider use.

Overall, this chapter shows how AR/VR can improve Simoldes digital communication and client experience, supporting the company's marketing efforts and international growth.

5.2.Data Analysis

This section presents the outcomes of the research based on both primary and secondary data. These results aim to assess the feasibility of integrating AR/VR technologies into Simoldes operations and their potential to enhance product visualization and client engagement.

- Primary Data Analysis

The interview conducted with Simoldes Marketing Director during the company visit in February 2025 provided essential insights into the current communication practices and challenges within the company:

- **Challenges in Product Visualization:** The Marketing Director explained that it is often difficult for Simoldes to effectively present its complex molds and automotive components to clients especially international ones through traditional methods such as 2D images or brochures. Physical samples, while useful, are not always practical for

global sales processes. This limitation impacts the way clients perceive the product's value and complexity, potentially reducing interest or delaying decisions.

- **Sales and Communication Difficulties:** Simoldes sometimes struggles to clearly communicate technical information about its products to clients who may not be familiar with the specifics of automotive mold-making. This gap in understanding can create confusion or slow down negotiations. The Marketing Director expressed a strong interest in more interactive, engaging solutions that allow clients to explore products in real time.
- **Openness to Technological Innovation:** The company is open to adopting new tools that could modernize how it showcases products and interacts with clients. AR/VR was viewed positively, with the main concerns being related to cost, scalability, and integration with Simoldes current systems and infrastructure.

- Secondary Data Analysis

Findings from market research reports and technology reviews further reinforced the potential benefits of implementing AR/VR in industrial and B2B settings:

- **AR/VR Adoption Trends:** McKinsey's *Technology Trends Outlook 2024* highlights AR/VR as a growing trend in industrial operations. These technologies are already helping companies improve product demonstrations, training, and operational planning making them ideal for manufacturers like Simoldes that deal with complex components (McKinsey & Company, 2024).
- **Manufacturing Industry Benefits:** According to Deloitte's *2023 Manufacturing Industry Outlook*, AR/VR solutions are being used to increase customer satisfaction and improve operational agility. Several companies in the manufacturing space have successfully integrated immersive technologies to reduce costs, improve client understanding, and stand out in competitive markets (Deloitte, 2023).
- **Technology Capabilities and Suitability:** A review of leading AR/VR platforms such as Microsoft HoloLens, Unreal Engine, and Unity revealed that these technologies support 3D modeling, real-time rendering, and compatibility with engineering tools like CAD and PLM software. Among them, Microsoft HoloLens and Unreal Engine stood out for their industrial applications, user-friendliness, and integration potential (Microsoft, 2023; Epic Games, 2023).

By combining insights from the interview with industry trends and technology reviews, the research suggests a strong alignment between Simoldes needs and the capabilities of AR/VR tools:

- ❖ There is a real need for improved product visualization methods at Simoldes, particularly to support global sales and remote client interactions.
- ❖ AR/VR technologies have already demonstrated success in enhancing client engagement and product understanding in similar industries.
- ❖ Microsoft HoloLens and Unreal Engine are especially suitable for Simoldes due to their technical features, immersive experience, and compatibility with existing digital systems.

5.3. Augmented Reality/Virtual Reality Concept and Design

The use of Augmented Reality (AR) and Virtual Reality (VR) technologies in the industrial sector has been gaining increasing attention due to their ability to create immersive, engaging, and interactive experiences for users. In the context of this project, the proposed AR/VR solution aims to support Simoldes marketing and client engagement strategies by offering a digital experience that enables clients to explore products virtually, understand their technical features, and interact with them in a realistic and intuitive environment. This approach is particularly valuable for a B2B manufacturing company like Simoldes, where clients are often geographically dispersed and where physical product demonstrations can be logistically challenging and costly.

The solution concept involves developing a virtual space that replicates Simoldes product offering in a 3D environment. Clients will be able to access this space either through a web-based platform or using AR-compatible mobile devices. Within this environment, clients can navigate a virtual showroom that displays the company's products in an organized and interactive manner. They will be able to select individual components, rotate them, zoom in to examine specific technical details, and view animations that illustrate how the products function or are assembled in a real-world context.

The main features of the solution are designed to enhance product understanding and increase engagement. These include:

- ◇ **High-quality 3D product visualization**, where each item is digitally modelled with realistic textures and dimensions.
- ◇ **A virtual showroom** that mimics a physical exhibition space and allows for free navigation.
- ◇ **Interactive demonstrations** that guide the user through the different use cases or technical attributes of each product.
- ◇ **A customization tool** to enable users to experiment with different variables, such as product color, material, or fitting options, depending on the component's nature.

Another important element of the solution is its potential integration with existing systems, such as Simoldes website (which is built on WordPress) and Customer Relationship Management (CRM) platforms. This integration ensures that client interactions within the AR/VR platform can be monitored and followed up efficiently by the sales and marketing teams. For example, if a client interacts with a particular product model for a long time or requests more information, this behavior can be captured and stored within the CRM for future communication or personalized offers.

The anticipated benefits of implementing this AR/VR solution are multiple and strategically important:

- ❑ Enhanced customer experience, differentiating Simoldes from competitors.
- ❑ Improved communication through visual and interactive product presentations.
- ❑ Support for internationalization, reducing dependency on physical meetings or sample shipments.
- ❑ Post-pandemic relevance, aligning with accelerated digital transformation trends.

To facilitate user adoption and ensure usability, the platform will be designed with:

- ❑ A user-friendly interface aligned with Simoldes branding.
- ❑ Intuitive navigation with interactive prompts and visual cues.
- ❑ Seamless end-to-end interaction, allowing clients to request quotes or feedback directly from the experience.

The example user flow begins with:

1. Clients receive a link/QR code → Access the AR/VR platform.
2. Enter a branded virtual environment → Browse product categories.
3. Interact with 3D models, view animations, and customize options.

4. Submit inquiries or feedback, linking to commercial opportunities.

The solution can be built using:

- **WebAR Frameworks (For Augmented Reality on Mobile Browsers):** To create no-download AR experiences that users can access directly through their smartphone browsers (e.g., Chrome, Safari).

Examples:

- **8th Wall:** A powerful platform for building AR experiences that work on any smartphone via a web link. No app installation is required.
- **Zappar:** Another tool for WebAR, offering features like image tracking, 3D model rendering, and interactive animations.

- **Accessibility:** Clients can open AR content instantly by scanning a QR code or clicking a link no app store downloads.

- **Cross-Platform:** Works on both iOS and Android.

- **Low Barrier:** Ideal for marketing campaigns, virtual showrooms, or product demos where ease of access is critical.

Use Case for Simoldes: A client scans a QR code in a brochure → Their phone camera launches a 3D model of a Simoldes product → They can place it in their real-world environment (e.g., on a factory floor) to visualize scale/design.

- **VR Development Tools (For High-Immersion Virtual Reality):** To build fully immersive VR experiences for use with headsets (e.g., Meta Quest, HTC Vive), ideal for deep product exploration or training, examples include:

- **Unity:** A versatile game engine used to create 3D VR environments with realistic physics, lighting, and interactivity.
- **Unreal Engine:** Known for ultra-high-fidelity graphics, suitable for photorealistic industrial simulations.

- **Depth of Interaction:** Users can "walk through" a virtual factory, disassemble products, or test configurations in a lifelike 3D space.

- **High Impact:** Best for trade shows, sales demos, or client meetings where immersion drives engagement.

- **Scalability:** Once built, VR apps can be deployed on multiple headsets or integrated with enterprise systems.

At a trade show, a client wears a VR headset → They enter a virtual replica of Simoldes showroom → They pick up and examine a 3D model of a car component, watching an animation of how it assembles into a vehicle.

Table 3. Comparison Table: WebAR vs. VR Development

Features	WebAR (8th Wall, Zappar)	VR (Unity, Unreal Engine)
Accessibility	Mobile browser (no install)	Requires VR headset/app download
User Reach	Broad (any smartphone)	Limited to headset owners
Immersion Level	Lightweight (AR overlays)	Fully immersive (3D environments)
Development Cost	Lower (subscription-based)	Higher (custom coding, assets)
Best Use Cases	Marketing, quick demos	Training, engineering reviews

Source: Author's own elaboration

This table highlights the key differences between WebAR and VR solutions. WebAR prioritizes accessibility and broad reach, offering lightweight AR experiences via mobile browsers with lower development costs ideal for marketing and quick demonstrations. In contrast, VR platforms deliver full immersion through headsets, enabling deep interaction for training and engineering reviews, albeit with higher costs and limited user accessibility due to hardware requirements. The choice depends on the use case: WebAR for scalable engagement, VR for high-fidelity simulations.

The AR/VR Experience Visualization is presented to complement the conceptual design of the proposed AR/VR solution, this section includes visual mockups and descriptive illustrations that demonstrate how the immersive experience would function for Simoldes clients. These visuals, generated using ChatGPT's image generation capabilities based on prompts specifically created for this project, serve to translate abstract ideas into tangible user interface scenarios, showcasing the core features, navigation flow, and client interaction points of the digital solution. Each image is followed by a brief explanation to highlight its role within the overall user journey.

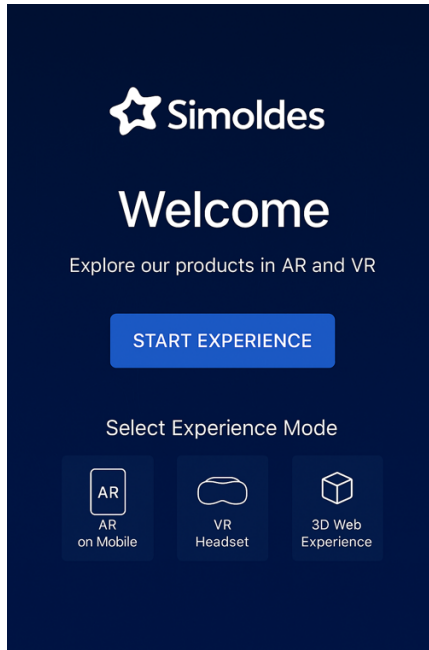


Figure 7. Welcome Interface

This screen serves as the entry point into Simoldes AR/VR experience. Designed with a clear call to action, it allows users to start their journey and select their preferred mode of interaction Augmented Reality, Virtual Reality, or a 3D Web Experience. The interface is clean, user-friendly, and visually aligned with Simoldes brand identity.

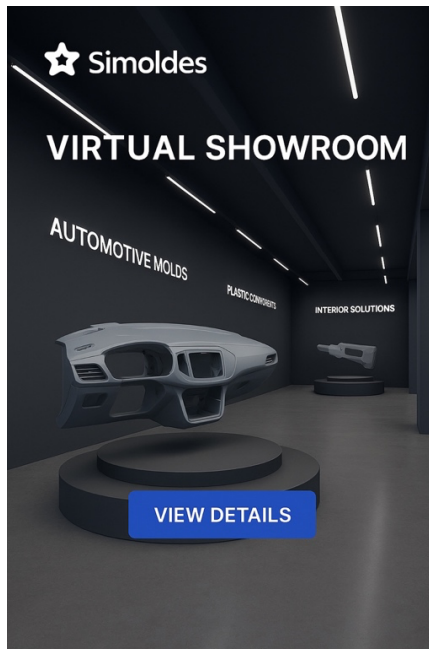


Figure 8. Virtual Showroom

The virtual showroom provides users with an immersive environment where they can explore Simoldes main product categories. It replicates a physical exhibition space using 3D models

and intuitive navigation, allowing clients to move between sections like Automotive Molds, Plastic Components, and Interior Solutions.

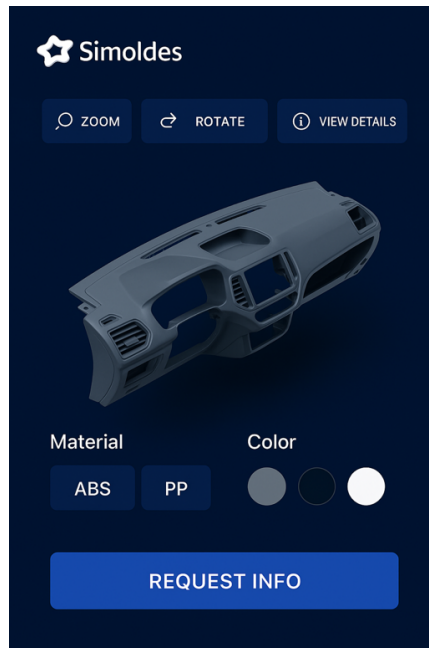


Figure 9. 3D Product Viewer and Customization Panel

This screen enables users to interact with a detailed 3D model of a Simoldes product. Core features include zooming, rotating, and accessing technical details. Additionally, the user can select material types and color variations to simulate customization options, enhancing the depth and personalization of the experience.

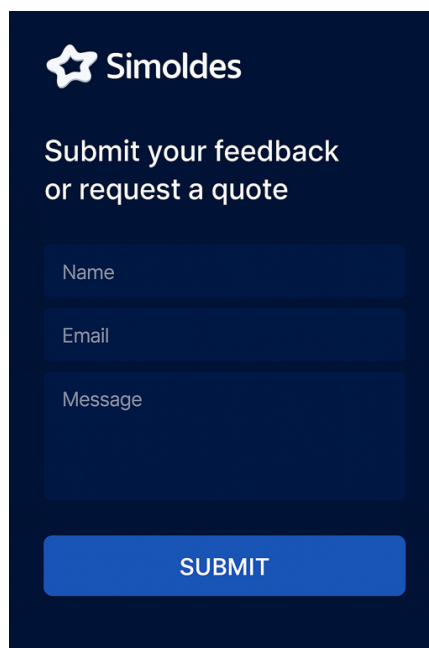


Figure 10. Feedback and Request Form

At the conclusion of the AR/VR experience, users are encouraged to submit feedback or request a product quote. This minimalistic form collects basic information (name, email, and message) and ensures that the engagement translates into actionable communication with Simoldes commercial team.

5.4. Integration with Existing Platforms

For the AR/VR solution to work effectively, it needs to connect smoothly with Simoldes existing systems like their website and customer database. This section explains how to make these connections work properly while keeping the system easy to use, compatible with different devices, and ready for future growth. These integrations will help customers interact better with products while giving the company useful data.

For successful implementation, the AR/VR solution must work smoothly with Simoldes current digital systems, especially its WordPress website. Using WebAR technology, interactive 3D models can be embedded directly into web pages, allowing users to experience AR without downloading extra apps. This makes it easier for clients to explore products in an engaging way while keeping the experience consistent with Simoldes brand identity.

To achieve this, Simoldes can use WordPress plugins (e.g., for 8th Wall or Zappar) to integrate AR features seamlessly. Additionally, WebGL (Web Graphics Library) and WebXR (Web Extended Reality) technologies ensure the content works across different devices and browsers, improving accessibility. (Solanke, 2025)

The solution can also connect with Simoldes Customer Relationship Management (CRM) system, tracking how users interact with 3D models such as which products they view the longest or customize most. This data helps refine marketing strategies and product development, as research shows immersive tech boosts customer engagement (Mbonigaba, Sujatha, Kumar, & Vasuki, 2024).

When developing the AR/VR solution, it's essential to consider compatibility, usability, and scalability. These factors are explained below:

Compatibility: Ensuring that the AR/VR solution is compatible with various devices and operating systems is paramount. The use of WebAR technologies facilitates this by allowing experiences to run on standard web browsers without requiring specialized hardware. This

approach aligns with best practices in deploying immersive technologies, which emphasize the importance of cross-platform compatibility to maximize user reach (Solanke, 2025).

Usability: The AR/VR system should be simple and comfortable for all users, regardless of their technical skills. To achieve this:

- The interface must be intuitive (easy to understand without instructions)
- Navigation should be clear, with visual guides and responsive controls
- Design should adapt to different devices (phones, tablets, computers)

Research proves that good AR/VR design keeps users engaged and satisfied (Frontiers in Virtual Reality, 2022). For Simoldes, this means:

- Faster adoption by clients
- More effective product demonstrations
- Better overall experience

Scalability: As Simoldes continues to grow by adding new products and reaching more clients, it is important that the AR/VR solution can also grow and adapt. A scalable system means that new features, updates, or product categories can be added easily without the need to rebuild the entire platform. This can be achieved by using cloud-based technologies and a modular design, where different parts of the system are developed separately and can be updated independently. This flexible structure helps ensure that the AR/VR platform stays reliable and effective over time, even as the company’s digital needs evolve or new technologies emerge (Solanke, 2025).

Table 4. AR/VR Must-Haves

Features	Goals	Solution Examples
Compatibility	Reach all users, regardless of device	WebAR + WebXR standards
Usability	Ensure effortless interaction	Guided tutorials + responsive design
Scalability	Support future growth	Cloud-based hosting + modular development

Source: Author’s own elaboration

This table shows the technical requirements for an effective AR/VR system. First, it needs to work on all devices using WebAR and WebXR standards. Second, it should be easy to use with

clear instructions and designs that adapt to different screens. Third, the system must be able to grow using cloud technology and modular components.

In conclusion, successfully integrating the AR/VR solution into Simoldes existing digital systems requires thoughtful planning in three main areas: technical compatibility, user-friendly design, and the ability to scale in the future. By following these principles and making use of modern technologies, Simoldes can strengthen its digital presence and offer more innovative and engaging experiences to its clients.

5.5. Pilot Testing

Before fully launching the AR/VR solution across all digital platforms, it is essential to conduct a pilot test to evaluate its performance, usability, and overall effectiveness. The goal of the pilot phase is to identify any potential issues, gather user feedback, and determine whether the solution meets the needs and expectations of its target audience. This step is particularly important for innovative technologies like AR/VR, which often involve new user behaviors and interaction patterns.

The proposed pilot testing will involve a small group of internal stakeholders (such as employees from the sales and product development teams) and a limited number of selected B2B clients who already have an established relationship with Simoldes. These users will be invited to test a pre-release version of the AR/VR experience, available either on the Simoldes website or through a secure demo link. The test environment will include core functionalities, such as the virtual showroom, 3D product viewer, customization panel, and the feedback/request form.

To ensure that the pilot provides meaningful insights, a set of key performance indicators (KPIs) and qualitative feedback tools will be used. The following metrics are proposed to evaluate the success of the AR/VR solution during the pilot phase:

- **User Satisfaction:** Participants will complete a short survey rating their overall experience, ease of use, and perceived value of the AR/VR platform.
- **Engagement Rates:** Metrics such as time spent in the virtual environment, number of products interacted with, and customization attempts will be tracked through integrated analytics tools.
- **Technical Performance:** Data will be collected on loading speed, compatibility across devices, and any system errors or bugs encountered.

- **Task Completion Rate:** For specific test scenarios (e.g., customizing a product and submitting a request), completion rates will be monitored to assess usability.
- **Qualitative Feedback:** Open-ended questions in the feedback form will allow users to share opinions, suggestions, and pain points in their own words.

The pilot testing phase will last approximately one to two weeks. After it concludes, the data collected will be analyzed to identify strengths and areas for improvement. Based on the findings, adjustments will be made to the AR/VR interface, performance, and content before proceeding to full deployment.

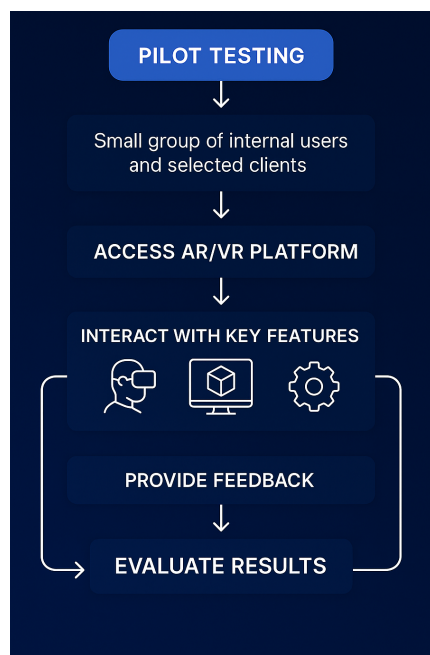


Figure 11. Visual Concept for AR/VR Pilot Testing

This image presents a visual concept that would be used during the pilot testing phase. It highlights the AR/VR experience layout that selected users would interact with while exploring features and submitting feedback as part of the evaluation process.

In summary, the pilot test serves as a valuable step in validating the AR/VR solution’s readiness. It allows Simoldes to reduce implementation risks, improve user satisfaction, and ensure that the final version of the platform delivers a high-quality, client-focused experience.

5.6. Summary

This chapter began with an analysis of the research results, combining insights from a company interview and industry research to understand Simoldes current communication challenges and the potential of AR/VR technologies. These findings helped shape a clear and creative proposal for how Simoldes can use Augmented Reality and Virtual Reality to improve its marketing and client experience. By creating a digital showroom and interactive 3D models of its products, the company can offer clients a modern way to explore and understand its work without the need for physical meetings or product samples.

Two types of experiences were proposed. Web-based AR is easy to access and perfect for quick demonstrations through a phone browser, while immersive VR is ideal for deep product exploration using headsets. Both options serve different goals and can help Simoldes stand out in a competitive market.

The design of the platform will focus on making it simple, realistic, and compatible with different devices. Integration with Simoldes website and client database will make it easy for the sales team to follow up and personalize the experience. Key features like 3D product views, customization tools, and feedback forms will make the platform useful and interactive.

Before launching fully, a pilot test will be carried out with selected clients and internal teams. This will help identify any problems and gather feedback to make the final version stronger and more effective.

In short, AR and VR can help Simoldes modernize its client interactions, support international growth, and create a memorable digital experience that brings its products to life in a smart and efficient way.

6. Conclusion

This project aimed to explore how Augmented Reality (AR) and Virtual Reality (VR) technologies can be used to improve client engagement and product presentation at Simoldes, a leading player in the automotive mold manufacturing industry. By combining primary insights from an in-person visit and interview with the Marketing Director, along with extensive secondary research, this study developed a practical understanding of the company's needs and outlined strategic ways to implement immersive technologies.

The research addressed five specific objectives, each contributing to the overall project outcome:

1. Current Challenges in Client Engagement and Product Demonstration:

The findings confirmed that Simoldes faces difficulties in effectively communicating complex mold designs to international clients, especially when relying on static 2D images or brochures. Clients often struggle to understand technical aspects of the products without seeing them in person. This gap can delay decision-making and reduce client interest.

2. AR/VR-Based Concept Tailored to Simoldes:

A virtual showroom concept was designed, allowing clients to interact with Simoldes products in a 3D environment. This concept includes features like rotating and zooming into components, animations that explain functionality, and customization panels to suit client needs. This solution aims to make product communication more engaging and accessible, especially for remote clients.

3. Feasibility in Terms of Compatibility, Usability, and Scalability:

The study found that AR/VR tools, particularly WebAR and platforms like Microsoft HoloLens, are technically compatible with Simoldes current digital systems, including CAD and PLM. These technologies are user-friendly and scalable, meaning they can grow as the company introduces new products or expands into new markets.

4. Integration Strategy:

A clear integration plan is proposed that connects AR/VR tools with Simoldes existing workflows. It includes training staff, minimizing disruption, and ensuring the immersive experience works across devices. The strategy also considers resistance to new technology by making the platform intuitive and aligning it with the company's operational goals.

5. Pilot Testing to Measure Impact:

A pilot test was proposed involving internal teams and select clients. The test would evaluate key performance indicators such as client engagement, time spent on the platform,

ease of customization, and overall satisfaction. This phase would help collect useful feedback and fine-tune the final implementation.

Based on the findings, some recommendations are suggested:

- Begin with a small-scale AR/VR pilot program focused on product demonstration and client interaction.
- Use WebAR or hybrid platforms to reduce hardware costs and increase accessibility.
- Involve both technical and commercial teams during development to ensure the solution supports marketing and engineering needs.
- Offer training to internal users and educate clients about the new immersive experience to improve adoption.
- Monitor user feedback and performance metrics closely during the pilot phase to refine the tool before wider rollout.

Although this project was designed for Simoldes, the ideas and tools presented could also be useful for other companies in manufacturing or similar B2B industries. Many businesses face challenges when explaining complex products, especially in international markets. AR and VR technologies offer a modern, flexible way to improve product presentation and client interaction, making them a valuable option beyond this single case.

This study was based on one company visit and a single semi-structured interview, which limited access to broader stakeholder perspectives or technical data from inside the company. While the visit provided valuable insights, more detailed input from engineering, IT, or international sales teams would have strengthened the analysis. The research also relied heavily on publicly available documents, which limited access to internal performance metrics or proprietary innovation strategies.

Future studies could build on this work by conducting a full pilot implementation and evaluating client reactions over time. Another interesting direction would be to compare different AR/VR platforms in real industrial settings to measure user experience, return on investment, and integration ease. Expanding research to include feedback from clients and technical teams across different countries would help see how the solution could be accepted globally.

In conclusion, this project demonstrates that AR/VR technologies can provide a powerful solution to Simoldes communication and marketing challenges. With thoughtful planning and

a user-centered approach, immersive tools can help the company stay innovative, improve client relationships, and maintain its competitive edge in the evolving manufacturing industry.

References

- Aromaa, S., Väättänen, A., Väänänen, K., & Salmimaa, M. (2018). User experience and user acceptance of virtual reality training for industrial maintenance work. *Proceedings of the 20th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct*, 127–134.
- Arora, A., Dufresne, A., & Kurien, P. (2010). Virtual reality applications in logistics and supply chain management. *Journal of Business Logistics*, 31(2), 1-16.
- Berg, L. P., & Vance, J. M. (2017). Industry use of virtual reality in product design and manufacturing: A survey. *Virtual Reality*, 21(1), 1-17.
- Bottani, E., & Vignali, G. (2019). The impact of virtual reality on manufacturing industry: A review of the literature. *International Journal of Computer Integrated Manufacturing*, 32(10), 957-971.
- Boyd, D. E., & Koles, B. (2019). An introduction to the immersive digital world: The impact of augmented and virtual reality on brand experiences. *Journal of Business Research*, 100, 441–444.
- Boyd, D. E., & Koles, B. (2019). Virtual reality and its impact on B2B marketing: A state-of-the-art analysis. *Industrial Marketing Management*, 79, 154–162.
- Boyd, D.E., & Koles, B. (2019). Virtual showrooms and demonstrations: Cost-effective strategies in B2B marketing. *Journal of Business & Industrial Marketing*, 34(7), 1456-1465.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
- Cipresso, P., Giglioli, I. A. C., Raya, M. A., & Riva, G. (2018). The past, present, and future of virtual and augmented reality research: A network and cluster analysis of the literature. *Frontiers in Psychology*, 9, 2086.
- Choi, S., Heo, J., & Lee, M. (2015). Virtual prototyping in manufacturing industries: A case study. *International Journal of Advanced Manufacturing Technology*, 78(5–8), 865–876.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

Dwivedi, Y. K., Hughes, L., Baabdullah, A. M., Ribeiro-Navarrete, S., Giannakis, M., Al-Debei, M. M., ... & Wamba, S. F. (2022). Metaverse Marketing: How the Metaverse Will Shape the Future of Consumer Research and Practice. *Psychology & Marketing*, 40(5), 915-943.

Flavián, C., Ibáñez-Sánchez, S., & Orús, C. (2023). The emotional impact of AR/VR on B2B buyers: Building stronger client relationships. *Journal of Business Research*, 145, 1-10.

Fraga-Lamas, P., Fernández-Caramés, T. M., & Suárez-Albela, M. (2018). A survey on industrial augmented reality. *Journal of Industrial Information Integration*, 10, 70-84.

Gavish, N., Gutiérrez, T., Webel, S., Rodríguez, J., Peveri, M., Bockholt, U., & Tecchia, F. (2015). Evaluating virtual reality and augmented reality training for industrial assembly tasks. *Computers in Industry*, 70, 42-50.

Guo, P., Wang, T., & Wu, L. (2020). Virtual reality-based training for industrial workers: Improving safety and efficiency. *Computers in Industry*, 122, 103281.

Jeong, S. H., Lee, H. Y., & Lee, J. G. (2016). The impact of augmented and virtual reality on B2B sales strategies: Case studies and future directions. *Industrial Marketing Management*, 59, 58-71.

Javornik, A. (2016). Augmented reality: The new frontier for marketing? *Journal of Brand Management*, 23(6), 1-14.

Kvale, S. (2007). *Doing Interviews*. SAGE Publications.

Losheniuk, L., Kasyanov, I., & Kasyanova, I. (2023). Applications of augmented and virtual reality in business: Innovations in B2B marketing. *Journal of Business Research*, 145, 1-10.

Luo, H., Li, G., Feng, Q., Yang, Y., & Zuo, X. (2019). The impact of virtual reality on spatial ability and procedural knowledge in manufacturing training. *International Journal of Advanced Manufacturing Technology*, 104(5-8), 2345-2356.

- Makransky, G., Terkildsen, T. S., & Mayer, R. E. (2019). The role of personalized feedback in virtual reality training. *Computers & Education*, 130, 13-25.
- Mbonigaba, C., Sujatha, S., Kumar, A. D., & Vasuki, M. (2024). *Exploring the impact of AR and VR on enhancing customer experiences and driving sales in retail*. *International Journal of Interdisciplinary Research in Arts and Humanities*, 9(2), 87–94.
- Masood, T., & Egger, R. (2019). Augmented reality in support of Industry 4.0: Implementation challenges and success factors. *Robotics and Computer-Integrated Manufacturing*, 58, 181–195.
- Masood, T., & Egger, R. (2019). Virtual reality in manufacturing and its applications. *Procedia CIRP*, 81, 646-651.
- Mourtzis, D., Vlachou, E., & Tsiakos, A. (2020). The role of virtual and augmented reality in future manufacturing systems. *Procedia CIRP*, 93, 139-144.
- Mütterlein, J. (2018). The three pillars of virtual reality? Investigating the roles of immersion, presence, and interactivity. In *Proceedings of the 51st Hawaii International Conference on System Sciences*, 1407–1415.
- Nicholson, M. E., Lee, H. S., & Thomas, P. J. (2017). The role of augmented reality in customer engagement: Evidence from a global survey. *Journal of Interactive Marketing*, 37, 10-21.
- Okorie, G. N., Arifin, S. R. M., & Arora, S. (2024). Integration of Artificial Intelligence along with AR and VR to Ensure Effective Digital Marketing Strategies. *Nanoscale Reports*, 17(5), 2986-2998.
- Palmarini, R., Erkoyuncu, J. A., Roy, R., & Torabmostaedi, H. (2018). A systematic review of augmented reality applications in maintenance. *Robotics and Computer-Integrated Manufacturing*, 49, 215–228.
- Palmarini, R., Giordano, M., & Bottani, E. (2018). Augmented reality for industrial maintenance: A review. *International Journal of Advanced Manufacturing Technology*, 98(1-4), 249-267.

Porter, M. E., & Heppelmann, J. E. (2017). Why every organization needs an augmented reality strategy. *Harvard Business Review*, 95(2), 46-57.

Poushneh, A., & Vasquez-Parraga, A. Z. (2017). Customer adoption of augmented reality in B2B settings. *International Journal of Marketing*, 45(4), 88-102.

Scholz, J., & Duffy, D. (2018). The role of augmented and virtual reality in business-to-business marketing. *Journal of Business Research*, 79, 237-245.

Wang, F., Ong, S. K., & Nee, A. Y. C. (2016). A comprehensive survey of augmented reality applications in manufacturing. *Advanced Manufacturing*, 4(1), 23–36.

Wiederhold, B. K. (2020). Ready or not, here comes XR (extended reality)!. *Cyberpsychology, Behavior, and Social Networking*, 23(1), 1-2.

Wieland, H., Klee, D., & Wagner, R. (2024). Augmented and Virtual Reality in Managing B2B Customer Experiences. *Industrial Marketing Management*, 105, 13-25.

Web Sources

Afia. (2023). *Simoldes Plastics* [PDF]. Afia. Retrieved May 29, 2025, from https://afia.pt/wp-content/uploads/2023/12/20231220231121_0016sp.pdf

Deloitte. (2023). *2023 manufacturing industry outlook*. Deloitte Insights. Retrieved May 29, 2025, from <https://www2.deloitte.com>

Epic Games. (2023). *Unreal Engine for manufacturing*. Retrieved May 29, 2025, from <https://www.unrealengine.com>

Frontiers in Virtual Reality. (2022). Evaluating usability and user experience of AR applications in VR environments. *Frontiers in Virtual Reality*, 8. Retrieved May 29, 2025, from <https://www.frontiersin.org/articles/10.3389/frvir.2022.881318/full>

HQSoftware. (2024). *How augmented and virtual reality are transforming the automotive industry*. HQSoftware. Retrieved May 29, 2025, from <https://hqsoftwarelab.com/solutions/ar-vr-in-automotive/>

McKinsey & Company. (2024). *Technology trends outlook 2024*. McKinsey Digital. Retrieved May 29, 2025, from <https://www.mckinsey.com>

Microsoft. (2023). *Microsoft HoloLens for industry*. Retrieved May 29, 2025, from <https://www.microsoft.com>

Sapien. (2025). *The role of AR/VR in enhancing customer engagement and sustainability in the automotive sector*. Sapien. Retrieved May 29, 2025, from <https://www.sapien.io/blog/ar-vr-in-the-automotive-industry>

Simoldes. (2025). *Future Automotive Cockpit & Storage (FACS) project overview*. Simoldes. Retrieved May 29, 2025, from <https://www.simoldes.com/en/innovation-plastics/facs-future-automotive-cockpit-storage/>

Simoldes Group. (2023). *Sustainability report 2021-2022* [PDF]. Simoldes. Retrieved May 29, 2025, from https://www.simoldes.com/wp-content/uploads/2023/12/SIMOLDES_Relatorio2021_2022_AF_Digital_Dupla-1.pdf

Simoldes Group. *About us*. Simoldes. Retrieved May 29, 2025, from <https://www.simoldes.com/en/about-us-simoldes/>

Simoldes Group. *Plastics Division: About Simoldes Plastics*. Simoldes. Retrieved May 29, 2025, from <https://www.simoldes.com/en/plastics/empresa/>

Simoldes Group. *Tools Division overview*. Simoldes. Retrieved May 29, 2025, from <https://www.simoldes.com/en/tools/company-simoldes/>

Solanke, A. (2025). *Deploying immersive AR/VR technologies for enterprise collaboration: Technical infrastructure, security considerations, and scalability*. ResearchGate. Retrieved May 29, 2025, from <https://www.researchgate.net/publication/390208212>

Universidade Católica Portuguesa. SIMOLDES - *The impact of additive manufacturing: 3D printing*. Retrieved May 29, 2025, from <https://repositorio.ucp.pt/bitstream/10400.14/16813/1/201113627.pdf>

Supplementary Sources

Simoldes Group. *Code of ethics and conduct*. Retrieved May 29, 2025, from https://www.simoldes.com/wp-content/uploads/2022/06/Codigo_Etica_EN_SP_M009PG01_V02_02.06.2022-1.pdf

Simoldes Group. *Simoldes Group*. Retrieved May 29, 2025, from <https://www.simoldes.com/en/>

Simoldes Group. *Novo Banco and Jornal de Negócios export & internationalisation*. Retrieved May 29, 2025, from <https://www.simoldes.com/en/posts-plastics/novo-banco-and-jornal-de-negocios-export-internationalisation-2/>

Annex

Interview Script with Simoldes Marketing Director

Date of Interview: 20 February 2025

Location: Simoldes Headquarters, Oliveira de Azeméis, Portugal

Type of Interview: Semi-structured, conducted during an in-person visit to Simoldes facilities

Interviewee: Marketing Director of Simoldes

Purpose: To gather insights on Simoldes current marketing strategies, technological adoption, and perspectives on integrating AR/VR into its operations.

Q1: Has Simoldes considered using Augmented Reality (AR) or Virtual Reality (VR) technologies before?

Q2: Would you describe Simoldes as technologically advanced, or do you follow a more traditional approach?

Q3: How does Simoldes approach marketing and client engagement today?

Q4: Which part of the production or sales process do you think could benefit the most from AR/VR?

Q5: Can you explain the meaning behind Simoldes logo?