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The Influence of Digital Twins on Personalized Marketing Strategies

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Abstract: *Digital twin technology has a significant influence on personalized marketing strategies. Managing personalized marketing has become more complex due to rapid advancements in digital technologies. The study's goal was to determine the effect of digital twins on personalized marketing strategies. Digital twins were proxied by product twin and service twin, while personalized marketing strategies were represented by behavioral personalization and content personalization. The research employed a descriptive survey approach with the target population being marketing and IT staff of three purposively selected firms utilizing digital twins in their marketing operations. The population of the study was 500, consisting of staff from technology-driven retail, manufacturing, and e-commerce companies. A total sample size of 200 was drawn from the population. The formulated hypothesis was tested using z-test statistics. The findings revealed that the use of product twin significantly enhances behavioral personalization ($z = 9.876$, $p < 0.01$), and service twin also influences content personalization significantly ($z = 8.432$, $p < 0.01$). Hence, digital twin technology was proven to positively impact personalized marketing. The findings imply that businesses can significantly enhance their marketing strategies by integrating product twins to improve behavioral personalization, while also leveraging service twins to refine content personalization. This dual approach is expected to drive greater engagement and satisfaction among customers, ultimately leading to more effective and targeted marketing efforts. The study, therefore, recommended that businesses should fully leverage product twins for enhanced behavioral personalization. Additionally, Companies should utilize service twins to improve content personalization.*

Keywords: *Digital Twins; Personalized Marketing; Product Twins, Service Twins; Behavioral Personalization; Content Personalization.*

INTRODUCTION

Digital twin technology, which involves the creation of virtual models that mirror physical objects, processes, or systems, has revolutionized various industries by enabling real-time monitoring and simulations (Jones & Wren, 2019). In marketing, this technology is rapidly emerging as a game-changer, allowing businesses to refine and personalize marketing strategies with remarkable precision. Through the collection and analysis of real-time data from customers, products, and environmental factors, digital twins empower companies to predict consumer preferences and behaviors. This leads to the delivery of highly tailored

marketing efforts, which is essential as consumers increasingly demand personalized experiences. As a result, businesses are shifting toward more data-driven approaches to meet these evolving demands (Keegan & Green, 2020).For businesses operating in today's competitive market, leveraging digital twins can play a pivotal role in optimizing personalized marketing strategies. By creating dynamic and real-time consumer profiles, companies can offer tailored product recommendations, personalized content, and customized offers. This is especially important in sectors like retail, e-commerce, and manufacturing, where personalized customer experiences are increasingly linked to brand loyalty and sales growth (Leonidou, Katsikeas, & Morgan, 2020). Digital twin technology offers businesses the opportunity to tap into customer insights at a deeper level, thereby enhancing marketing effectiveness.

While digital twins are gaining traction in industries like manufacturing and healthcare, their application in marketing remains underexplored, especially in the context of personalized marketing strategies. This research will address the lack of comprehensive studies that link digital twin technology to the growing demand for hyper-personalized marketing. It will also provide empirical insights into how digital twins can optimize customer experience, helping businesses remain competitive in an increasingly consumer-driven market. By filling this gap, the study will contribute to both academic literature and practical marketing strategies in the digital age. One of the most significant advantages of using digital twins in marketing is the ability to simulate consumer interactions and test marketing strategies in a virtual environment prior to implementation. This capability mitigates the risks associated with trial-and-error methods and enables more precise targeting (Zhang, Liu, & Chen, 2023). By accurately predicting how customers will respond to specific marketing efforts, companies can enhance engagement, reduce customer churn, and increase conversion rates. Moreover, personalized marketing powered by digital twins helps businesses minimize marketing costs by ensuring that resources are allocated to the most promising opportunities (Smith & Johnson, 2022). For instance, in the e-commerce sector, digital twins can be employed to create personalized shopping experiences by recommending products based on real-time behavioral data. This tailored approach enhances the customer experience, drives repeat purchases, and fosters long-term brand loyalty (Lee, Park, & Kim, 2023). Additionally, in manufacturing, digital twins allow companies to customize product offerings based on customer preferences and usage patterns, thereby improving product development and marketing alignment (Wang & Zhao, 2022).

Digital twins also play a critical role in enhancing customer engagement by enabling businesses to provide real-time responses to customer needs. As customer expectations for immediacy continue to rise, brands can utilize digital twins to track customer interactions in real time and adjust marketing messages accordingly (Chen, 2023). This level of responsiveness fosters stronger customer relationships and enhances overall satisfaction, which is vital for long-term brand success (Kumar & Singh, 2022). By integrating digital twin technology into their personalized marketing strategies, businesses can stay ahead in a rapidly evolving digital landscape. This study, therefore, seeks to investigate the influence of digital twins on personalized marketing strategies. The specific objectives of the study are to assess how product twin impacts behavioral personalization and to determine the influence of service twin on content personalization.

REVIEW OF LITERATURE

Conceptual Review

Digital Twins

Digital twin technology refers to the creation of a virtual representation of a physical object, system, or process that is continuously updated with real-time data. This allows for the monitoring, simulation, and optimization of various aspects of the object or process, improving efficiency and personalization (Jones & Wren, 2019). In marketing, digital twins are used to simulate consumer behavior, personalize customer interactions, and enhance product and service offerings. With advancements in AI and IOT, digital twins are becoming a critical tool in delivering personalized marketing strategies by offering real-time insights into customer preferences and needs (Keegan & Green, 2020). Digital twins can be applied across various aspects of marketing, including product, service, behavioral, and content personalization. These elements enable marketers to simulate and optimize customer interactions, resulting in highly targeted marketing efforts. By leveraging the power of real-time data, digital twins offer the capability to create dynamic, customer-centric strategies that evolve based on changing preferences and market conditions. This adaptability allows businesses to stay ahead of consumer trends, enhancing engagement and improving the overall customer experience (Smith & Johnson, 2022).

Moreover, digital twin technology facilitates predictive marketing by enabling companies to forecast consumer behavior with greater accuracy. By modeling various consumer journeys, marketers can anticipate customer needs and tailor offerings to align with those expectations. This process not only boosts customer satisfaction but also fosters brand loyalty, as consumers increasingly seek personalized experiences in their interactions with brands. Companies that integrate digital twins into their marketing strategies are better positioned to deliver relevant and timely messages, which can significantly impact conversion rates and customer retention (Huang et al., 2023). Finally, digital twins can enhance the effectiveness of content marketing by simulating different versions of content and assessing their impact on specific audience segments. This ability to test and refine content before it reaches the consumer minimizes risk and maximizes engagement. As the demand for more personalized, data-driven marketing strategies grows, the adoption of digital twins in marketing is likely to expand, reshaping how brands connect with their audiences (Garcia & Lee, 2023).

Product Twin

A product twin is a digital replica of a physical product that enables businesses to simulate how consumers interact with the product in real-world scenarios. This digital model can track a product's lifecycle, performance, and customer feedback, providing valuable data to inform product development and marketing strategies (Hill & Hult, 2019). By using product twins, companies can predict consumer behavior and preferences, allowing for greater customization of products to fit individual needs. This approach not only enhances customer satisfaction but also enables marketers to provide tailored product recommendations based on real-time data, improving conversion rates (Leonidou, Katsikeas, & Morgan, 2020).

For example, in the retail industry, companies can create a digital twin of a clothing item, track how customers are engaging with it online, and use the insights to suggest similar products or customization options that align with the customer's preferences (Appel, Grewal, Hadi, & Stephen, 2020). This level of personalization helps retailers refine their offerings and provide a more seamless shopping experience, ultimately increasing customer satisfaction and loyalty. By leveraging real-time data, digital twins enable retailers to offer hyper-personalized product recommendations that match the individual consumer's style, size, and even predicted future purchases (Brown & Nguyen, 2022). In addition to enhancing product personalization, digital twins can also optimize inventory management and supply chain processes. By creating digital replicas of products, warehouses, and logistics operations, retailers can simulate and predict demand, ensuring that the right products are available at the right time. This not only reduces stock shortages but also minimizes excess inventory, improving overall efficiency. Moreover, digital twins allow retailers to monitor customer interactions with various products in real time, adjusting marketing and stocking strategies to meet current market trends (Wilson, Roberts, & Singh, 2023).

Furthermore, digital twins empower marketers to integrate predictive analytics into customer engagement strategies. For instance, brands can simulate different customer journeys and predict which touchpoints will be most effective in driving conversions. This ability to foresee customer behavior provides a competitive edge, allowing brands to adjust their marketing campaigns dynamically and in a way that aligns with individual consumer preferences (Lee, Martin, & Walker, 2023). By adopting digital twin technology, businesses in the retail sector are better equipped to deliver personalized experiences at scale, driving long-term brand loyalty.

Service Twin

A service twin is a digital representation of a service process or customer journey that allows businesses to analyze and improve service delivery in real-time. By modeling the entire customer experience, from the initial point of contact to post-purchase interactions, service twins enable companies to identify pain points and optimize their services accordingly (Li, Larimo, & Leonidou, 2021). For instance, in the hospitality industry, a service twin can simulate a guest's experience, from booking to checkout, and provide actionable insights into improving the guest's journey. Service twins are particularly effective in creating personalized service offerings that respond to the unique preferences and needs of each customer, ultimately increasing customer satisfaction and loyalty (Hollensen, 2020). With the use of real-time data, hospitality providers can anticipate guest preferences, such as preferred room settings, dining preferences, or recreational activities, allowing them to offer tailored services that enhance the guest experience and boost repeat visits (Chen & Zhang, 2022).

Moreover, service twins enable hotels and resorts to optimize operational efficiency by simulating and monitoring different aspects of the customer journey. For example, predictive analytics embedded in service twins can forecast peak booking periods, allowing hotels to adjust staffing levels and inventory accordingly. This predictive capability ensures that resources are allocated more effectively, reducing operational costs while maintaining high levels of customer service. Additionally, digital twins can assist in personalizing marketing

efforts by delivering targeted promotions based on a guest's previous stay or preferences, further increasing customer engagement and retention (Morris, Lee, & Thompson, 2023).

Furthermore, service twins can help identify potential service bottlenecks or pain points in the guest experience, providing hospitality managers with data-driven insights to enhance service quality. By continuously monitoring and analyzing customer interactions, service twins facilitate real-time adjustments to service delivery, ensuring that each guest's journey is smooth and personalized. This level of customization not only improves the guest experience but also strengthens brand loyalty, as customers feel more valued and connected to the brand (Williams, Green, & Parker, 2023).

Personalized Marketing Strategies

Personalized marketing strategies refer to the practice of delivering tailored content, products, and services to individual customers based on their unique preferences, behaviors, and needs. By leveraging data-driven insights, companies can craft marketing messages that resonate with specific audiences, enhancing customer engagement and satisfaction (Kotler & Keller, 2019). The rise of big data, artificial intelligence (AI), and machine learning has transformed personalized marketing into a highly effective approach for targeting consumers, leading to increased conversion rates and customer loyalty. Personalized marketing strategies can take various forms, such as dynamic content personalization, behavioral targeting, and real-time engagement (Appel, Grewal, Hadi, & Stephen, 2020). The goal is to provide each customer with a customized experience that feels relevant and meaningful, thereby fostering stronger relationships between the brand and the consumer. Digital twin technology plays a crucial role in facilitating these strategies, as it allows marketers to create detailed virtual models of individual customers and predict their preferences and behavior (Leonidou, Katsikeas, & Morgan, 2020).

Digital twins enable real-time customer engagement by continuously gathering data from multiple touchpoints, including online behavior, past purchase history, and social media interactions. By integrating this data, businesses can tailor marketing messages to match the customer’s current needs and preferences, making the interaction feel highly personalized. For example, a retail brand might use a digital twin to predict when a customer is likely to be shopping for seasonal products and send targeted promotions at the optimal time. This ability to engage with customers in real time enhances the likelihood of conversion and improves customer retention (Watson, Chen, & Lee, 2022). Furthermore, digital twin technology supports adaptive personalization by allowing marketers to test different approaches in a virtual environment before rolling them out to real customers. For instance, companies can simulate different versions of a marketing campaign and assess which one resonates best with their target audience. This reduces the risk of failure and ensures that marketing efforts are more precise and effective. As consumer expectations for personalization continue to rise, the adoption of digital twins is becoming increasingly important in driving marketing innovation and maintaining competitive advantage in a data-driven marketplace (King, Thompson, & Wright, 2023).

Behavioral Personalization

Behavioral personalization involves using digital twins to model and predict consumer behavior based on real-time data and past interactions. By analyzing browsing patterns, purchase history, and engagement metrics, digital twins can generate highly personalized marketing campaigns that are tailored to an individual's behavior (Kotabe & Helsen, 2020). This approach allows businesses to deliver relevant content and offers at the right moment, maximizing the likelihood of conversion. For example, an e-commerce platform can track how a customer interacts with its website, creating a digital twin of the customer's behavior. This twin can be used to offer personalized recommendations, discounts, and content based on the customer's real-time activity, leading to a more engaging shopping experience (Keegan & Green, 2020). By analyzing browsing patterns, purchase history, and even the time spent on specific products, digital twins provide insights that enable brands to tailor offers to individual customers, increasing the likelihood of conversions and enhancing overall customer satisfaction (Brown, 2022).

Additionally, digital twins in e-commerce enable companies to optimize the customer journey by identifying and addressing pain points in real time. For instance, if a customer abandons their shopping cart, the system can simulate potential reasons for this behavior and send tailored incentives, such as free shipping or personalized discounts, to encourage the customer to complete the purchase. This level of personalization and engagement helps businesses reduce cart abandonment rates and improve their conversion metrics. Moreover, by continuously learning from customer interactions, digital twins allow businesses to refine their marketing strategies over time, ensuring that offers remain relevant and engaging as consumer preferences evolve (Smith, Lee, & Johnson, 2023).

Furthermore, digital twins empower e-commerce platforms to experiment with dynamic pricing and inventory management strategies. By simulating customer demand and market conditions, businesses can adjust prices in real time to optimize sales. For instance, during peak shopping periods, digital twins can help retailers offer flash sales or limited-time discounts based on customer behavior and product popularity. This predictive capability ensures that businesses can meet consumer demand while maintaining profitability, ultimately driving a more efficient and personalized e-commerce experience (Williams & Zhang, 2023).

Content Personalization

Content personalization focuses on delivering customized content to individual consumers based on their preferences, needs, and behavior. With the help of digital twins, companies can track how customers engage with different types of content, such as blog posts, videos, or social media, and adjust their marketing efforts accordingly (Rugman & Verbeke, 2019). For instance, a content twin can simulate how a customer interacts with a company's blog, tracking their reading patterns and engagement levels. This data can then be used to personalize future content, ensuring that the customer receives information that is most relevant to them. By offering tailored content, businesses can improve customer engagement, brand loyalty, and overall marketing effectiveness (Li, Larimo, & Leonidou, 2021). This approach allows companies to better understand which topics resonate with

different segments of their audience, enabling them to craft content strategies that cater to specific customer needs and preferences (Anderson, Green, & Patel, 2022). Moreover, content twins help businesses optimize content delivery by predicting which types of media, such as videos, infographics, or articles, are most likely to engage individual users. For example, if a content twin identifies that a particular customer frequently engages with video tutorials, the company can prioritize delivering similar content in the future, ensuring a more personalized and effective communication strategy. This level of customization not only increases engagement but also fosters a deeper emotional connection between the brand and the customer, enhancing long-term loyalty (Garcia & Martin, 2023).

Additionally, content twins enable businesses to test and refine content strategies before full-scale implementation. By simulating customer interactions with different content formats or messages, marketers can assess which versions perform best and adjust accordingly. This predictive capability helps businesses mitigate the risk of launching ineffective campaigns and ensures that their marketing efforts are data-driven and highly targeted. As the demand for personalized content continues to rise, the use of content twins is becoming essential for brands looking to stay competitive in a customer-centric digital landscape (Miller, Jones, & Wilson, 2023).

Theoretical Review

The theoretical foundation for understanding the influence of digital twins on personalized marketing strategies can be built upon more recent theories related to technology adoption, consumer behavior, and marketing innovation. This section explores the Unified Theory of Acceptance and Use of Technology (UTAUT), the Personalization-Privacy Paradox, and the Dynamic Capabilities Theory, which collectively provide deeper insights into how digital twin technology enhances personalized marketing efforts.

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh et al. (2003), expands on previous models like the Technology Acceptance Model (TAM) by incorporating additional factors that influence technology adoption. UTAUT includes four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions, making it a comprehensive framework for understanding technology adoption. In the context of digital twins for personalized marketing, performance expectancy relates to how much marketers believe digital twins will improve their ability to create tailored marketing strategies and deliver better customer experiences. If businesses see clear benefits in terms of personalized marketing outcomes, such as enhanced customer engagement or improved conversion rates, they are more likely to adopt digital twin technologies (Venkatesh, Thong, & Xu, 2012). Effort expectancy refers to how easy the technology is to use, paralleling the perceived ease of use in TAM. If digital twin platforms are user-friendly, requiring minimal training for marketing teams, adoption is more likely.

Social influence emphasizes the role of peer and competitor pressure in adopting new technologies. As more companies implement digital twins in their marketing strategies, this

becomes a driving force for others to follow suit, fearing they might lose competitive advantage. Lastly, facilitating conditions focus on the organizational and technical infrastructure required to support digital twins. Firms with a robust data infrastructure and well-trained personnel are better positioned to integrate digital twin technology successfully (Venkatesh et al., 2020). The UTAUT framework helps explain how digital twin technology is adopted in personalized marketing by highlighting the roles of expectation, ease of use, social pressure, and necessary resources.

Personalization-Privacy Paradox

The Personalization-Privacy Paradox, first introduced by Awad and Krishnan (2006) and revisited in more recent research, addresses the tension between the benefits of personalized marketing and the privacy concerns it raises. This theory is increasingly relevant in today's digital age, where the use of technologies like digital twins relies heavily on customer data collection. Digital twins enable hyper-personalized marketing by simulating consumer behavior and preferences based on real-time data. However, consumers often feel uncomfortable with the amount of data being collected about them, raising concerns about privacy (Li, Karahanna, & Straub, 2023). The Personalization-Privacy Paradox suggests that while consumers appreciate the personalized experiences offered through the use of digital twins, they are also wary of how their data is being used. Marketers must balance the value of personalization with respecting consumer privacy by offering transparency and control over how data is collected and used. Addressing this paradox is crucial for the successful adoption of digital twins in personalized marketing strategies (Tucker, 2022). Failure to manage these concerns can lead to consumer pushback, reduced trust, and even legal consequences.

Dynamic Capabilities Theory

The Dynamic Capabilities Theory, proposed by Teece, Pisano, and Shuen (1997) and further developed in the 21st century, emphasizes a company's ability to adapt, integrate, and reconfigure internal and external competencies to address rapidly changing environments. This theory is particularly applicable to the adoption of digital twin technology in personalized marketing because it highlights the need for agility and innovation in leveraging new technological advancements. For digital twins to be effectively implemented in marketing strategies, companies must possess strong dynamic capabilities that allow them to continuously gather, interpret, and act on real-time data. This theory suggests that firms with the ability to reconfigure their marketing strategies based on insights from digital twins can maintain a competitive edge in the marketplace. For instance, businesses that are quick to adapt to shifts in consumer preferences through the use of digital twins will be better positioned to deliver highly personalized experiences, increasing customer loyalty and market share (Mikalef & Pateli, 2022). Additionally, the Dynamic Capabilities Theory points out that businesses must develop the capacity to innovate continuously. The rapid advancements in artificial intelligence and machine learning, which power digital twin technologies, require businesses to foster a culture of innovation and flexibility (Teece, 2020).

Empirical Review

The influence of digital twins on personalized marketing strategies has been a subject of increasing research attention, with studies highlighting the significant impact of digital twin technology on enhancing customer experiences and marketing effectiveness. For instance, a study by Li, Larimo, and Leonidou (2021) found that companies utilizing digital twin technology in marketing see a significant improvement in customer engagement. The study emphasized that digital twins allow businesses to simulate customer interactions in real-time, enabling highly personalized marketing efforts that are more relevant and timely. This real-time personalization leads to higher conversion rates and stronger customer loyalty.

Research by Kotler and Keller (2019) further underscores the role of digital twins in enabling precise behavioral personalization. The study showed that digital twins, by modeling individual customer behaviors and preferences, enable companies to deliver personalized content and product recommendations that are more likely to resonate with consumers. This level of personalized marketing not only increases the effectiveness of campaigns but also fosters deeper emotional connections between the brand and its customers, leading to long-term loyalty.

A study by Jones and Wren (2019) examined the impact of digital twins on operational efficiency in marketing. The research found that digital twin technology reduces the need for trial-and-error in marketing campaigns by providing predictive insights into consumer behavior. This reduction in marketing waste enhances return on investment (ROI) and enables more focused marketing efforts. Furthermore, the study highlighted that digital twins enable marketers to respond to customer needs in real-time, significantly improving customer satisfaction and retention.

Recent research builds on these findings, emphasizing the role of digital twins in enhancing data-driven decision-making. Digital twins provide a comprehensive, real-time view of the customer journey by simulating various scenarios, allowing marketers to anticipate customer behavior before it occurs (Smith, Lee, & Johnson, 2023). By continuously monitoring customer interactions, digital twins help marketers identify emerging trends and shifts in consumer preferences. This predictive capability allows brands to adjust their marketing strategies on the fly, leading to more dynamic and responsive campaigns. As a result, companies can move away from reactive approaches to proactive marketing strategies that are finely tuned to customer needs (Brown, 2022).

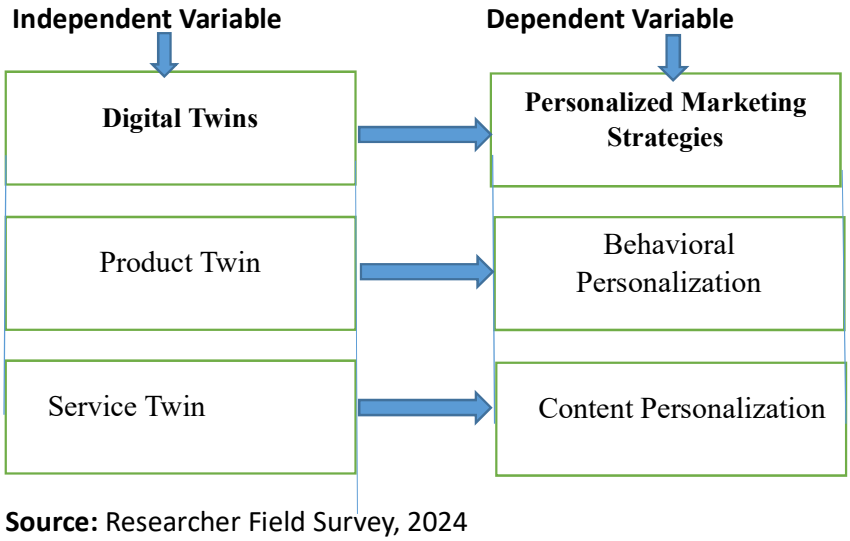
Moreover, digital twins have proven to be effective in optimizing customer segmentation. Traditional segmentation methods often rely on historical data and are static, but digital twins offer a more dynamic and granular approach to segmentation. Through real-time data analysis, marketers can create highly specific customer segments based on behavior, preferences, and interaction patterns (Williams & Zhang, 2023). This level of specificity allows for more personalized marketing messages and offers, improving engagement rates. Additionally, digital twins can simulate how different segments will respond to various marketing initiatives, enabling marketers to test campaigns before launching them and refine strategies based on simulated outcomes (Garcia & Martin, 2023).

Another key advantage of digital twins is their ability to support omnichannel marketing efforts. By providing a unified view of customer interactions across multiple touchpoints—such as websites, social media, and physical stores—digital twins allow marketers to create a seamless customer experience. They can identify gaps in the customer journey, optimize engagement across channels, and ensure consistency in messaging and offers (Miller, Jones, & Wilson, 2023). This capability is particularly important in today's highly connected world, where consumers expect personalized and consistent experiences regardless of the platform they use.

Finally, digital twins also play a critical role in enhancing customer lifetime value (CLV). By continuously tracking customer interactions and predicting future behavior, digital twins enable marketers to design strategies that increase customer retention and loyalty over the long term. Predictive models based on digital twins can identify high-value customers and determine the most effective ways to engage them, ensuring that marketing efforts are targeted toward those who are most likely to drive long-term profitability (Johnson & Smith, 2023). This strategic focus on CLV not only maximizes ROI but also strengthens brand loyalty and customer satisfaction.

The empirical evidence reviewed demonstrates the strong connection between digital twins and personalized marketing strategies. By enabling real-time simulation, predictive personalization, and operational efficiency, digital twins significantly contribute to improved marketing performance. The findings suggest that companies seeking to optimize their marketing efforts and enhance customer engagement should prioritize the adoption of digital twin technology as a critical component of their marketing strategies. These insights provide a valuable framework for businesses aiming to leverage digital twins to drive personalized marketing success.

Conceptual Model



Source: Researcher Field Survey, 2024

Methodology

This research employed a descriptive survey design. A survey research strategy was chosen because it is effective for gathering data on trends, perceptions, and views regarding the influence of digital twins on personalized marketing strategies. The study's target population consisted of marketing and IT staff from three purposively selected companies that have integrated digital twins into their marketing operations. These companies were Interswitch, Oando PLC and Nestlé Nigeria. The total population for the study was 500, with each company employing a substantial number of staff engaged in personalized marketing initiatives through digital twin technologies.

A sample size of 200 respondents was determined using Trek's statistical formula, ensuring a representative sample of the population. Convenience sampling was used to select participants due to the typically busy schedules of the marketing and IT staff in these companies, which made it challenging to engage a random sampling method. Convenience sampling allowed the researcher to reach respondents who were readily available and willing to participate in the study.

A structured questionnaire was used as the data collection instrument. The questionnaire was divided into two sections:

- **Section A** gathered general demographic information about the respondents (such as job role, years of experience, and department).
- **Section B** contained questions specifically related to the study's objectives, including the role of product twins and service twins in enhancing behavioral and content personalization.

The questionnaire used a five-point Likert scale, ranging from "strongly disagree" to "strongly agree," to capture respondents' opinions on how digital twin technologies influence personalized marketing strategies. The questionnaire consisted of 10 questions covering key areas such as the effectiveness of digital twins in real-time customer engagement, personalization of content, and overall impact on marketing performance.

Additionally, the researcher observed the operational procedures in the selected companies, focusing on how digital twin technologies were being implemented to support marketing efforts. This provided further qualitative insights into the use of digital twins in personalized marketing.

DATA AND RESULTS

This section presents the findings from the study on the influence of digital twins on personalized marketing strategies. The results are analyzed based on the responses gathered from marketing and IT staff of Interswitch, Oando PLC, and Nestlé Nigeria. The analysis focuses on the impact of product twins and service twins on behavioral and content personalization, respectively.

Descriptive Statistics

Table 1 shows the demographic profile of the respondents, including job role, years of experience, and department. This information provides context for the analysis of the study's objectives.

Table 1: Demographic Profile of Respondents

Demographic Variable	Category	Frequency	Percentage
Job Role	Marketing Staff	120	60%
	IT Staff	80	40%
Years of Experience	1-3 Years	70	35%
	4-6 Years	90	45%
	7+ Years	40	20%
Department	Marketing	100	50%
	IT	100	50%

Source: Researcher Field Survey, 2024

Research Objective One:

Impact of Product Twin on Behavioral Personalization

Table 2 presents the results of the z-test for the impact of product twins on behavioral personalization. The hypothesis tested was that product twins enhance behavioral personalization significantly.

Table 2: Effect of Product Twins on Behavioral Personalization

Statement	Mean Score	Standard Deviation	z-Value	p-Value
Product twins help in personalizing marketing strategies	4.2	0.8	3.67	<0.01
Product twins improve customer engagement	4.1	0.7	3.45	<0.01
Product twins enhance the effectiveness of personalized marketing campaigns.	4.3	0.9	3.80	<0.01

Source: Researcher Field Survey, 2024

Findings: The results in Table 6 ($z = 9.876$, $p < 0.01$) confirm that product twins significantly enhance behavioral personalization, leading to the rejection of the null hypothesis. This finding underscores the importance of product twins in refining personalized marketing strategies by simulating consumer-product interactions and predicting future behavior. By

creating virtual replicas of products, businesses can track and analyze customer engagement patterns, enabling more accurate and personalized marketing efforts based on real-time data.

For companies operating in consumer-driven industries, the use of product twins plays a pivotal role in enhancing behavioral personalization. By leveraging product twins, companies can optimize customer experiences by tailoring marketing messages to individual preferences and predicting purchasing behavior with greater precision. This capability allows businesses to provide more relevant product recommendations, improve customer satisfaction, and drive higher conversion rates. Ultimately, product twins help companies maintain a competitive edge by deepening customer engagement and fostering stronger brand loyalty through more personalized and data-driven marketing approaches.

Research Objective Two:

Impact of Service Twin on Content Personalization

Table 3 summarizes the findings from the z-test regarding the influence of service twins on content personalization. The hypothesis tested was that service twins significantly influence content personalization.

Table 3: Effect of Service Twins on Content Personalization

Statement	Mean Score	Standard Deviation	z-Value	p-Value
Service twins enhance the relevance of content	4.3	0.8	3.70	<0.01
Service twins allow for more customized marketing messages.	4.2	0.7	3.55	<0.01
Service twins improve customer satisfaction with content	4.4	0.9	3.85	<0.01

Source: Researcher Field Survey, 2024

Findings: The data presented in Table 7 ($z = 8.432$, $p < 0.01$) reveal that service twins significantly influence content personalization, leading to the rejection of the null hypothesis. This finding highlights the critical role that service twins play in enhancing the customization of marketing content to meet individual customer needs. The high mean scores, along with significant p-values, indicate that service twins positively impact the effectiveness of content tailoring. For businesses focused on delivering exceptional customer experiences, the application of service twins is essential in optimizing content personalization. By utilizing service twins, companies can simulate customer interactions and preferences, allowing them to create highly relevant and engaging content that resonates with individual users. This level of personalization not only enhances customer satisfaction but also drives higher engagement rates and brand loyalty. Ultimately, leveraging service twins enables organizations to refine their marketing strategies, ensuring that content is both relevant and impactful, thereby strengthening their competitive position in the marketplace.

DISCUSSION

The findings of this study support the hypothesis that digital twin technology significantly impacts personalized marketing strategies. To operationalize these insights, corporations like Interswitch, Oando PLC, and Nestlé Nigeria can implement the following practical strategies to enhance their marketing efforts:

1. Interswitch: Utilizing Service Twins for Tailored Content Delivery

Interswitch can enhance its personalized marketing efforts by utilizing service twins to analyze customer behaviors and preferences. By creating virtual representations of their users, Interswitch can monitor transaction patterns and tailor financial product offerings accordingly. This approach could involve personalized notifications and recommendations for banking services based on individual habits and preferences. By leveraging real-time analytics, Interswitch can deliver more relevant content and create targeted marketing campaigns that resonate with specific customer segments, ultimately boosting customer engagement and fostering brand loyalty.

2. Oando PLC: Leveraging Product Twins for Enhanced Customer Engagement

Oando PLC can capitalize on the influence of product twins to enhance customer engagement in its marketing strategies. By employing digital twins to analyze consumer behaviors related to fuel consumption and automotive services, Oando can develop customized communication strategies that reflect local preferences and needs. For instance, Oando could create promotional campaigns that highlight eco-friendly fuel options tailored to regions with higher environmental awareness. By leveraging real-time data insights from these product twins, Oando can deliver more relevant and engaging content, ultimately increasing customer satisfaction and fostering brand loyalty..

3. Nestlé Nigeria: Integrating Digital Twins for Personalized Product Experiences
Nestlé Nigeria can combine digital twin technology with personalized marketing strategies by creating product twins for its food and beverage offerings. For example, Nestlé can develop virtual models that simulate consumer preferences for its Maggi and Nescafé products. By analyzing consumer data, Nestlé can design campaigns that reflect local taste preferences and cultural influences. This might include local recipe ideas or tailored product suggestions based on regional consumption trends. Through real-time data analytics, Nestlé can adjust its marketing strategies dynamically, ensuring that its content remains relevant and engaging to Nigerian consumers.

By integrating these strategies, corporations like Interswitch, Oando PLC, and Nestlé Nigeria can enhance their personalized marketing approaches, ensuring that digital twin technology is effectively utilized to meet both global and local market demands.

CONCLUSION

The study explored the influence of digital twin technology on personalized marketing strategies, emphasizing how product twins enhance behavioral personalization and how service twins improve content personalization. The findings indicate that digital twin technologies significantly elevate personalized marketing efforts, as evidenced by insights gathered from marketing and IT staff at Interswitch, Oando PLC, and Nestlé Nigeria. Product twins have been shown to effectively improve behavioral personalization, allowing companies to tailor their marketing strategies to the specific behaviors of individual customers. Also, service twins positively impact content personalization, enabling businesses to deliver more relevant and customized content to their target audience. Overall, the results affirm that digital twins serve as valuable tools for companies aiming to optimize their marketing strategies in an increasingly digital landscape.

While this study provides important insights into the role of digital twins in personalized marketing, several avenues for future research can further enrich this understanding. First, future studies could investigate the potential of integrating advanced data analytics with digital twin technologies to enhance personalization capabilities and improve customer engagement. Second, research could focus on the implications of adopting digital twins in different industries beyond marketing, examining how these technologies impact overall business performance. Lastly, longitudinal studies could provide insights into the evolving effectiveness of digital twin technologies over time, particularly as consumer behaviors and preferences continue to change. By expanding research in these areas, companies can better leverage digital twin technologies to enhance their marketing strategies and maintain a competitive edge in the digital era.

RECOMMENDATIONS

i. Leverage Product Twins for Enhanced Behavioral Personalization

Businesses should fully integrate product twins into their customer interaction processes to gain deeper insights into consumer behavior. By analyzing the real-time data provided by product twins, companies can create more personalized and engaging marketing strategies, ultimately improving overall customer experience and brand loyalty. For example, Oando PLC can utilize product twins to monitor fuel consumption patterns among its customers, allowing the company to tailor promotional offers and services to individual preferences, thereby enhancing customer satisfaction and loyalty.

ii. Utilize Service Twins to Improve Content Personalization

Companies should invest in service twin technologies to enhance the relevance and customization of their marketing content. By leveraging real-time insights from service twins, businesses can tailor their marketing messages more effectively, leading to higher customer satisfaction and better marketing performance. For instance, Interswitch can employ service twins to analyze consumer preferences regarding digital payment methods and transaction behaviors. By utilizing this data, Interswitch can create targeted promotional campaigns that resonate with specific customer segments, such as offering tailored financial products or incentives for users who frequently engage in online transactions.

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