

Deriving Actionable Insights from Big Data to Enhance Customer Experiences Across the Consumer Journey

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Abstract

This research article explores how big data analytics can be leveraged across the different touchpoints of the consumer journey to derive actionable insights that lead to enhanced customer experiences. The massive amounts of data generated from multiple sources represent an invaluable asset for brands to understand audiences. This study examines current data sources like transactions, website behavior, social media, IOT devices etc. as well as analytical techniques spanning descriptive, predictive, prescriptive, and diagnostic methods. Using big data analytics contextually enables greater personalization, optimization and predictive interaction triggering across key stages of awareness, consideration, purchase, post-purchase, and loyalty. These techniques power use cases around defining lookalike segments for proactive engagement or determining channel mix influence across the journey to create seamless omnichannel experiences. However, brands need to focus on critical factors like data integration across systems, veracity and governance, evolving specialist skills in analytics/storytelling and cultural adoption to translate this potential into superior lifetime value across segments. Though data privacy and strategy misalignment remain ongoing challenges, benefits outweigh risks for brands bold enough to become insight-led across the customer journey. This research serves both as an approach guide and playbook for data-driven journeys.

Indexing terms: Big data analytics, customer experience, personalization, customer journey mapping, touchpoints

Introduction

The proliferation of data in the digital era presents a unique opportunity for brands to enhance their understanding of consumer behavior. As individuals engage with various digital platforms, including websites, mobile apps, Internet of Things (IoT) devices, and smart products, an extensive trail of data is generated. This data, comprising user behaviors, preferences, and experiences, is a goldmine for businesses seeking to refine their strategies and meet customer needs more effectively. The central question that emerges from this wealth of data is how organizations can efficiently transform it into actionable insights that drive value throughout the customer journey. This research delves into the current landscape of big data sources, analytics techniques, and practical use cases, with the overarching goal of elucidating strategies for implementing data-centric approaches to enhance customer experiences [1]. One fundamental aspect of this exploration is the identification of appropriate data sources. As the digital ecosystem expands, organizations must discern which data points are most relevant to their objectives and ensure the ethical collection of this information. This necessitates a comprehensive understanding of the multichannel nature of contemporary customer interactions, encompassing web interactions, mobile usage, IoT engagements, and interactions with smart products [2].

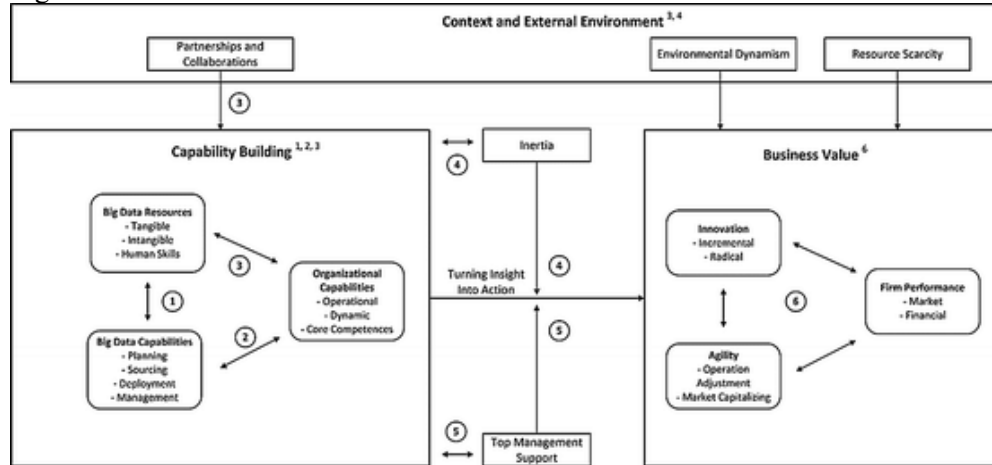
An integral component of leveraging big data is the seamless integration of information from diverse touchpoints. Organizations need to construct a cohesive data architecture that facilitates the aggregation and analysis of data from disparate sources. This integration is pivotal in constructing a holistic view of customer journeys, allowing brands to discern patterns and extract meaningful insights. The subsequent step involves the analysis of this aggregated data at scale. Advanced analytics techniques, including machine learning algorithms and predictive modeling, empower organizations to uncover latent patterns, identify opportunities, and make informed decisions [3].

The application of insights gained from big data analytics occurs in real-time and demands a customized approach [4]. This involves tailoring interactions based on the contextual understanding derived from the analyzed data. Real-time personalization enables brands to engage with customers in a manner that is not only relevant but also

timely, fostering a sense of resonance and connection. However, this process is not without its challenges.

One of the foremost challenges is ensuring the quality of the data being collected and analyzed. The sheer volume of data generated can lead to issues of accuracy and reliability. Organizations must implement robust data governance strategies to maintain data quality throughout its lifecycle [5].

Figure 1.



Additionally, the skills required to extract meaningful insights from big data are in high demand. Companies must invest in talent development or partnerships to ensure their teams possess the requisite expertise in data analytics, machine learning, and data science. Integration poses another significant challenge. The amalgamation of data from diverse sources requires a well-architected infrastructure capable of handling varied data formats and structures [6]. This demands substantial investments in technology and a strategic approach to integration to avoid silos that impede the flow of insights across the organization. Moreover, privacy considerations loom large in the era of data-driven decision-making. Striking a balance between personalization and privacy is a delicate task, necessitating adherence to stringent data protection regulations and the implementation of transparent privacy policies.

Background

In the realm of big data, the amalgamation of vast and diverse information assets poses a multifaceted challenge, necessitating a comprehensive approach to collation, processing, and interpretation. This challenge is particularly pronounced in dealing with high volumes, rapid velocities, and diverse varieties of data emanating from both online and offline sources. Examples of such data sources include clickstream data, purchase transactions, social media interactions, customer support calls, IoT sensor data, mobile location data, and content usage metrics. The complexity lies not only in the sheer magnitude of the data but also in its dynamic nature and the heterogeneity of formats and structures [7]. To navigate this intricate landscape, organizations employ advanced analytics techniques, delving into the depths of the data to unearth meaningful patterns and derive actionable insights. These analytics techniques encompass a spectrum of methodologies, including statistical analysis, machine learning, and data mining, aimed at discerning hidden correlations and trends within the data. The objective is to extract pertinent information that can guide strategic decision-making and enhance understanding of target audiences and their evolving needs [8].

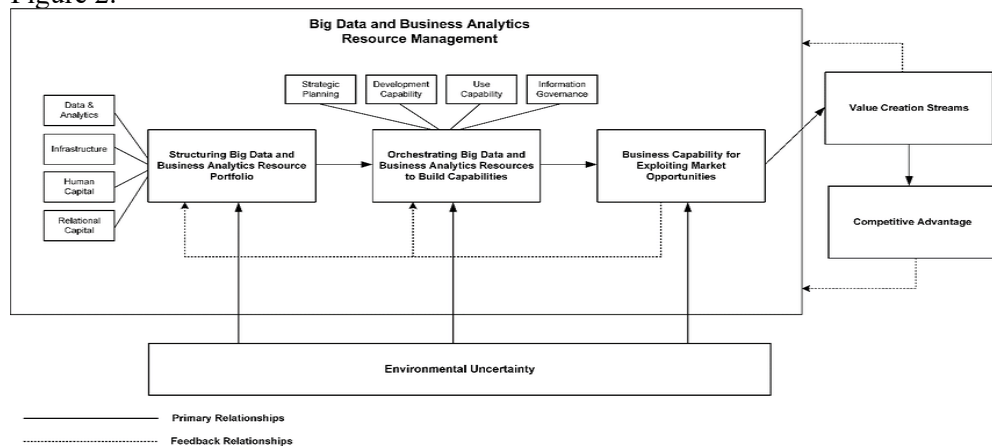
The application of advanced analytics extends beyond mere data interpretation; it serves as the linchpin for optimizing customer experiences across various channels. By discerning patterns in customer behavior and preferences, businesses can tailor their approaches to meet individualized needs, thereby fostering a more personalized and engaging interaction. This optimization of customer experiences is not a mere ancillary benefit; rather, it aligns directly with overarching brand objectives, facilitating the creation of a coherent and resonant brand image. In the pursuit of actionable insights, the integration of data from diverse sources becomes paramount. The holistic analysis of data streams from different channels provides a more comprehensive view of customer behavior and market dynamics [9]. Moreover, it enables organizations to identify latent opportunities and address potential challenges that may arise from the interplay of various factors. The integration of data from disparate sources, however, necessitates robust data management and integration strategies to ensure accuracy,

consistency, and relevance. As organizations delve into the intricacies of big data analytics, the significance of real-time processing emerges as a critical aspect. The velocity at which data is generated mandates swift analysis to extract timely insights. Real-time analytics not only enables businesses to respond promptly to emerging trends but also enhances the agility of decision-making processes. This is particularly relevant in dynamic market environments where staying ahead of the curve is contingent upon the ability to adapt swiftly to changing circumstances [10].

The scope of big data analytics also extends to predictive analytics, wherein historical data is leveraged to forecast future trends and outcomes. By employing predictive models, organizations can anticipate customer behavior, market trends, and potential challenges [11]. This foresight empowers businesses to proactively align their strategies, mitigating risks and capitalizing on emerging opportunities. The integration of predictive analytics into the big data framework adds a layer of strategic foresight, enabling organizations to position themselves advantageously in a rapidly evolving landscape.

The customer journey typically unfolds across five fundamental stages: awareness, consideration, purchase, service, and loyalty. These stages serve as a roadmap, guiding businesses to understand and cater to the evolving needs and expectations of their clientele. The mapping of these stages against various outreach channels such as social media, email, websites, and mobile apps provides a comprehensive view of the customer's engagement journey [12].

Figure 2.



In the contemporary business ecosystem, the application of big data analytics emerges as a cornerstone in enhancing the customer journey. By deploying advanced analytics in a contextual manner across these diverse touchpoints, companies can unlock a trove of insights that fuel greater personalization, real-time optimization, and predictive modeling at each phase of the customer's expedition. This analytical approach enables businesses to move beyond generic interactions and tailor their offerings based on individual preferences, behaviors, and feedback. The essence of this data-driven strategy lies in its ability to create a symbiotic relationship between the customer and the brand [13]. The insights derived from big data analytics empower companies to anticipate and meet customer needs proactively, fostering a sense of resonance and satisfaction. Real-time optimization ensures that the customer experience is dynamically adjusted, addressing pain points and capitalizing on opportunities swiftly. Crucially, predictive modeling fueled by big data analytics opens new frontiers in strategic planning. Businesses can forecast trends, identify potential bottlenecks, and devise preemptive measures to stay ahead of the curve. This proactive stance is particularly valuable in the competitive landscape, where anticipating market shifts and customer expectations can be the difference between success and stagnation.

Implementing a data-driven approach to enhance the customer journey necessitates a holistic and coordinated effort. It spans not only technological dimensions but also involves the cultivation of specific skills, the evolution of cultural mindsets, and the integration of systems. Data scientists, analysts, and professionals proficient in interpreting and applying insights play a pivotal role. Simultaneously, fostering a culture that values and prioritizes data-driven decision-making is imperative. The integration of systems ensures seamless data flow across departments, breaking down silos and enabling a unified understanding of the customer journey.

Sources of Big Data Across Customer Journey

The customer journey, a pivotal aspect of modern business strategy, draws insights from a myriad of data sources, creating a comprehensive understanding of consumer interactions. In the realm of online and digital touchpoints, metrics-driven feedback emanates from various behavioral data sources. Clickstreams, content usage patterns, search queries, purchases, submissions, and product/service usage statistics constitute the bedrock of this category, offering direct insight into consumer actions. Beyond behavior, profile data plays a crucial role, encompassing demographics, psychographics, preferences, and registered details. This wealth of information is instrumental in effective customer segmentation, facilitating targeted strategies [14].

Table 1: Key Sources of Big Data Across Customer Journey Stages

Journey Stage	Data Source Examples	Relevance for Analytics
Awareness	Social media conversations	Helps identify interest signals to map decision journeys
	Website analytics	Provides baseline metrics for marketing effectiveness
Consideration	Product brochures and content	Input for recommendation engine models
	Reviews platforms data	Enables voice of customer analysis on product USPs/pain points
Purchase	Campaign attribution data	Helps gauge channel contribution to sales
	Shopping cart transactions	Analyze behavior trends around cart abandonment
Service	Customer support transcripts	Input for sentiment analysis to strengthen service quality
	Product returns data	Identify product/service defects requiring rectification
Loyalty	Community forum activity	Helps schedule customer events during peak engagement seasons
	Customer usage behavior	Design tiered promotions based on purchase trends

Attitudinal data amplifies the understanding of the customer voice through feedback surveys, reviews, ratings, and social media conversations. This category captures the sentiment and preferences of the customer base, providing a nuanced perspective for businesses to adapt and refine their offerings [15]. Meanwhile, marketing data, which includes campaign metrics, channel performance, promo codes, and cost per lead data, stands as a cornerstone for optimizing outreach strategies. It empowers businesses to fine-tune their marketing efforts based on real-time performance indicators.

Operational data, derived from inventory, supply chain, procurement, and financials, supports the scalability of operations. In a similar vein, IoT and sensor data, sourced from connected devices, wearables, and appliances, enables real-time tracking, fostering a dynamic understanding of customer interactions. Furthermore, contextual data, encompassing weather information, store traffic, and events that may influence customer behavior, adds a layer of situational awareness [16].

The expanse of data is not confined solely to internal operations; external data, such as aggregated market data on competitors, economic trends, and regulatory changes, contributes valuable insights. This external perspective allows businesses to make informed decisions in a broader context. It is imperative to note that these data sources span first, second, and third-party realms, highlighting the need for effective integration into big data platforms. The synthesis of these diverse data sets is essential to connect insights seamlessly across various customer touchpoints, providing a holistic understanding of the customer journey and informing strategic decision-making processes.

Analytics Techniques

Various analytical approaches play a crucial role in extracting meaningful insights from the vast realm of big data. Descriptive analytics serves as the foundation, providing an

understanding of current and past performance through meticulous metric analysis, segmentation, and aggregation. This approach creates a reporting baseline, offering a quantitative evaluation of metrics across diverse marketing channels and touchpoints. Moreover, it involves an in-depth analysis of peaks and drops based on various attributes, contributing to a comprehensive comprehension of data trends. Moving beyond the descriptive phase, diagnostic analytics delves into the underlying reasons behind specific occurrences and patterns within the data. By addressing the "why" and "how" questions, this analytical technique identifies performance drivers. For instance, it involves the determination of high-value customer attributes and the mapping of customer journey patterns to pinpoint potential pain points in the user experience.

Table 2: Big Data Sources and Analytical Techniques for Customer Journey Stages

Journey Stage	Data Sources	Potential Analytical Techniques
Awareness	Social media, surveys	Descriptive analytics for metrics. Text mining to identify themes
	Geo-location data	Regression analysis on store footfalls data
Consideration	Past purchases, site search	Cluster analysis for customer segmentation. Affinity modeling for recommendations
	Reviews platforms	Sentiment analysis for product feedback
Purchase	Transaction data	Optimization algorithms to predict cart abandonment
	Campaign metrics	Attribution modeling to determine channel influence
Service	Support transcripts	Topic modeling to analyze complaint types
	Feedback surveys	Regression analysis to correlate NPS with service factors
Loyalty	Community interactions	Network analysis for influencer identification
	Customer usage data	Churn prediction models to forecast retention

Predictive analytics takes a forward-looking stance, employing statistical modeling across extensive historical datasets to forecast future outcomes and events. This proactive approach facilitates strategic decision-making by enabling organizations to anticipate demand for inventory management and model expected product usage for personalized pricing strategies.

In the realm of prescriptive analytics, a sophisticated integration of optimization algorithms with predictive modeling comes into play. This approach recommends the next best actions aligned with business objectives, prioritizing interventions to enhance overall efficiency. For example, it might involve dynamically customizing web experiences to optimize conversion rates or triggering contextually timed messages to encourage targeted purchases.

The amalgamation of various analytics techniques, including data mining, machine learning, optimization, and natural language processing, can be orchestrated by cross-functional teams. According to SAS (2020), this collaborative effort is essential to unearth and apply insights effectively. Moreover, considering the vast scale of big data, leveraging cloud platforms with nearly unlimited processing power becomes imperative for efficient analysis [17]. The overarching focus in this analytical landscape is not merely on data reporting but on deriving conversational and contextual insights that can drive informed decision-making.

Use Cases for Enhancing Customer Experiences

The integration of insight-driven strategies in enhancing customer experiences is pivotal in fostering meaningful brand interactions across different stages of the customer journey. At the awareness stage, leveraging external interest signals for predictive lead scoring enables the qualification of new prospects for targeted outreach, while the configuration of lookalike modeling algorithms facilitates the identification of potential customers resembling existing high-value segments [18]. Additionally, the analysis of social conversations and search data allows for the mapping of consumer decision journeys, thereby influencing considerations. Correlating location data with

external events further aids in decision-making regarding partnerships and contextual marketing opportunities, enhancing the presentation of tailored content for identified buyer personas during their initial site visits to improve engagement.

Moving to the consideration stage, the connection of site behavioral data with marketing analytics enables the assessment of channel influence and immerses customers in relevant content. Real-time product and content recommendations based on current site activity, facilitated by collaborative filtering, contribute to a personalized user experience. The application of sentiment analysis algorithms on reviews data highlights potential unique selling propositions (USPs) and pain points, while the construction of comparison models for competitors, based on market data benchmarks, delves into pricing and features [19]. Analyzing cart abandonment data becomes crucial at this stage, identifying and mitigating friction points that impact conversion rates [20].

Table 3: Challenges Associated with Using Big Data Analytics for Customer Journey Optimization

Key Challenges	Mitigation Strategies
Integrating disparate systems	Defined APIs, ETL tools, data lakes, middleware
Ensuring data veracity	Data quality frameworks, master data management
Building specialized skills	Cross-functional training programs
Selecting technology partners	Risk-benefit analysis on ownership vs partnerships
Maintaining data privacy	Consent management, encryption, anonymization
Cultural adoption across functions	Executive sponsorship, change management initiatives

In the purchase stage, tracking multi-channel purchase history becomes instrumental in determining channel affinity. Profiling customers allows for the assignment of tiered loyalty benefits and personalized promotions. Detecting payment failures based on transaction data triggers proactive support, and the integration of operational constraints around inventory and supply chain promises efficient cycle times. Observing environmental factors such as weather and events that influence propensity signals further refines the customer experience. Transitioning to the service stage, the capture of voice and text interactions across channels aids in training QA bots for faster issue resolution [21]. Detecting sentiment changes in customer support conversations facilitates agent coaching, while building recommender systems using catalogue data suggests complementary products. The application of time series forecasting identifies demand patterns and aids in staff scheduling. Analyzing returns data is essential for tracing product or service deficiencies, contributing to overall quality improvement.

In the loyalty stage, tracking renewal and attrition rates across cohorts informs targeted win-back campaigns. Modeling usage behavior allows for the crafting of personalized adoption and expansion nudges. Monitoring peak community engagement periods across regions facilitates the scheduling of live events. Profiling high-value brand advocates for evangelism and partner programs becomes crucial, as does tagging detractors based on critical social posts for service recovery.

These examples underscore the potential quick wins in aligning big data inputs with context-specific analytics models throughout the various phases of the customer journey. The synthesis of insights from both internal and external data assets presents a significant opportunity for preemptive and scalable personalization, thereby establishing a sustainable competitive advantage. However, achieving this requires organizations to possess the right vision, culture, capabilities, and governance [22].

Challenges in Implementation

The implementation of big data for enterprise-wide data-driven decision-making encounters several challenges that impede the seamless activation of customer touchpoints. One significant obstacle is the integration of disparate systems, where various applications capture fragments of customer interactions, but accessing and streamlining this data proves challenging due to organizational silos, resulting in blind spots that hinder a comprehensive view of customer interactions. Ensuring the veracity and quality of data is another critical challenge. Analytics can produce misleading outputs if the input data is incomplete, duplicated, or outdated. To address this,

governance frameworks must be established, focusing on accuracy, validity, consistency, and other parameters to ensure the reliability of the analytical outputs. Building specialized capability presents its own set of challenges, as data scientists often concentrate on modeling techniques, while business teams may lack the necessary acumen to translate analytics into actionable insights. Bridging this gap requires cross-functional coaching to enhance the understanding and collaboration between data scientists and business teams. Striking optimal external partnerships becomes essential, particularly for smaller brands seeking access to richer data assets, analytical tools, and niche expertise [23]. Evaluating the fitment and visibility of external partners is crucial to ensure that the collaboration aligns with the strategic objectives and requirements of the organization.

Maintaining data privacy has become increasingly complex with expanding regulations on ethical data usage. Addressing issues such as adequate consent capture, anonymization, and opt-out mechanisms is paramount to avoid violations and legal consequences.

Cultural adoption across functions is a fundamental challenge in implementing big data solutions. Insights derived from analytics need to be assimilated across various departments, including marketing, sales, and finance. Achieving this requires sustained change management efforts and effective communication strategies to facilitate the democratization of data throughout the organization.

Conclusion

This research paper has elucidated the strategic significance of leveraging big data throughout the customer journey to foster business growth by delivering enhanced experiences. The elucidation of how brands can effectively utilize a plethora of data sources, coupled with adept analytical methodologies, has been a focal point. This synergy facilitates the extraction of actionable insights pertaining to micro-segments, behavioral trends, predictive modeling, and campaign optimization. These insights, in turn, empower brands to execute targeted strategies across the five distinct phases of the customer journey, ensuring meaningful engagement, conversion, and retention through contextually relevant interactions. To harness the complete benefits of big data, brands must commit significant resources to various facets of their operations. An essential element is the development of integrated data architectures that enable seamless collection, processing, and analysis of vast datasets [24]. These architectures should be designed with scalability and flexibility in mind, accommodating the ever-growing volume and diversity of data. Concurrently, the establishment of specialized teams dedicated to data management, analytics, and interpretation is imperative. These teams play a pivotal role in translating raw data into actionable insights, guiding strategic decision-making processes. Additionally, fostering external partnerships with technology vendors, data providers, and industry experts is crucial. Collaborations with external entities bring diverse perspectives and expertise, enriching the overall data strategy. Moreover, realizing the full potential of big data requires a commitment to continuous technological adaptation. The rapid evolution of data technologies necessitates a proactive approach in staying abreast of the latest advancements. Brands must invest in ongoing training programs for their teams to ensure they are proficient in leveraging cutting-edge tools and methodologies. This commitment not only future-proofs data initiatives but also enhances the agility of the organization in responding to dynamic market conditions.

The paper emphasizes that the implementation of data-driven customer experience strategies is paramount for achieving sustainable differentiation in today's intensely competitive business landscape. However, the execution of such strategies demands a comprehensive approach. Aligning organizational priorities with data-driven objectives is fundamental. It requires a strategic integration of data initiatives into the broader business agenda, ensuring that data is not merely a supporting element but a driving force shaping the company's trajectory.

Ethical considerations form a critical aspect of this holistic approach. Brands must adhere to rigorous ethical standards in their data practices, respecting privacy, confidentiality, and transparency. As data-driven strategies often involve the collection and utilization of personal information, maintaining the trust of customers is paramount. This necessitates the implementation of robust governance structures that oversee data processes, ensuring compliance with regulatory frameworks and ethical guidelines. Establishing clear accountability and responsibility for data management further reinforces the ethical foundation of the organization's data practices. Cultivating a data-

centric culture within the organization is equally vital. This involves instilling an appreciation for data-driven decision-making at all levels of the workforce. Employees should be empowered with the skills and mindset to leverage data in their respective roles, fostering a culture where data is viewed not as an isolated asset but as a collective resource driving organizational success. Building this culture requires ongoing communication, training, and recognition of individuals and teams that exemplify data excellence.

Furthermore, developing the necessary capabilities to execute data-driven strategies is a multifaceted challenge. It encompasses not only technological expertise but also analytical skills, domain knowledge, and the ability to translate insights into actionable business initiatives. Brands must invest in talent acquisition and development programs to build a workforce equipped to navigate the complexities of big data. Additionally, creating a conducive environment for innovation encourages employees to experiment with new ideas and approaches, further enhancing the organization's capacity to derive value from data.

The transformative value unlocked by data-driven strategies is contingent upon the alignment of these multifaceted elements. Sustainable differentiation, as demonstrated by successful integration of big data insights into customer experience strategies, hinges on the collaborative efforts of diverse organizational facets. The emphasis on alignment extends beyond technological considerations to encompass ethical dimensions, governance frameworks, cultural shifts, and the development of requisite capabilities. In essence, the realization of transformational value from big data in customer experience necessitates a comprehensive and harmonized approach across the organizational spectrum. Brands that successfully navigate and integrate these elements are poised to not only meet evolving customer expectations but also to thrive in an era where superior customer experiences are synonymous with competitive advantage.

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