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The Digital Customer Intelligence Loop: Connecting Behavioral Data, Personalization Capability, Customer Engagement, and Business Performance

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Abstract

Digital firms increasingly operate in environments where customer interactions generate continuous streams of behavioral data. These data include browsing patterns, transactions, social media interactions, app usage, recommendation responses, and digitally mediated service encounters. At the same time, firms invest heavily in personalization systems intended to transform such data into more relevant customer experiences. Despite this progress, many organizations do not fully convert behavioral data and personalization investments into sustained engagement and business performance. The problem is not simply a lack of data or technology. Rather, firms often manage data collection, personalization, engagement, and performance as separate activities instead of treating them as dynamically connected elements of a continuous learning system. This article proposes the Digital Customer Intelligence Loop as an original conceptual model. The model links behavioral data, personalization capability, customer engagement, and business performance in a self-reinforcing cycle. It explains how engagement outcomes generate new behavioral signals that improve subsequent personalization and strengthen future performance. The proposed model identifies behavioral data as the input layer, personalization capability as the transformation layer, customer engagement as the behavioral response layer, and business performance as the value outcome layer. Five tables clarify the model's main components, including behavioral data types, personalization dimensions, engagement mechanisms, performance outcomes, and feedback dynamics. The framework offers researchers a basis for testing dynamic customer intelligence processes and gives managers a strategic tool for building continuous customer learning systems.

Keywords Conceptual model, Digital customer intelligence, Behavioral data, Personalization capability, Customer engagement, Business performance

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Introduction

Digital marketing has shifted customer management from episodic communication toward continuous interaction across search, social media, mobile applications, websites, platforms, and digitally enabled service channels. This shift has made customer behavior more observable, measurable, and analyzable than in earlier marketing

environments, allowing firms to capture granular traces of customer preferences, intentions, and responses [1]. Research on retailing and predictive analytics shows that these data-rich environments can support more precise targeting, demand prediction, and customer-level decision-making when firms possess the analytical capability to interpret behavioral signals [2].

The promise of personalization is that firms can use behavioral data to tailor content, recommendations, offers, and service experiences to individual customers or micro-segments. Artificial intelligence and machine learning have expanded this promise by enabling automated pattern recognition, real-time decision support, and adaptive engagement systems [3]. However, personalization is not only a technical process; it also requires marketing strategy, customer understanding, governance, and organizational alignment to turn analytics into meaningful customer value [4].

A central problem is that many firms treat behavioral data, personalization, engagement, and performance as a linear sequence rather than a feedback-based system. Customer engagement research shows that engagement includes cognitive, affective, and behavioral responses that can create value beyond immediate purchase, including advocacy, participation, and long-term relational outcomes [5]. Yet when engagement data are not systematically fed back into personalization systems, firms lose the opportunity to learn from customer responses and refine future interactions.

This article addresses that gap by proposing the Digital Customer Intelligence Loop as a conceptual model for digital customer management. The model argues that behavioral data fuel personalization capability, personalization shapes customer engagement, engagement contributes to business performance, and engagement itself generates new data that improve subsequent personalization. This loop-based view builds on customer engagement marketing theory [6], digital marketing research [1], and analytics capability perspectives that connect data resources to firm performance through dynamic organizational capabilities [7].

Behavioral Data in Digital Customer Management

Behavioral data refer to observable traces of customer actions across digital and digitally mediated environments. In digital marketing, these traces include clickstream paths, page views, search queries, cart activity, transaction histories, social sharing, reviews, location signals, app usage, and service interactions [1]. Retail analytics research further shows that such data can reveal customer preferences, purchase propensities, response patterns, and

journey-level frictions that are difficult to detect through traditional surveys or aggregate sales reports [2]. Behavioral data are valuable because they capture what customers actually do rather than only what they say they prefer. Social media research highlights that digital interactions can reveal attention, influence, sentiment, content diffusion, and community participation, thereby expanding the scope of customer intelligence beyond purchase data alone [8]. At the same time, customer experience research emphasizes that behavioral data must be interpreted within broader experience contexts because observed actions may reflect convenience, frustration, curiosity, habit, or emotional response rather than stable preference [9].

The usefulness of behavioral data depends on quality, integration, and responsible use. Fragmented customer data across channels can create incomplete profiles, inconsistent personalization, and inaccurate performance attribution, particularly when firms lack cross-channel integration and analytical governance [10]. Privacy research also shows that data-based marketing can create both performance benefits and customer risk perceptions, meaning that data collection practices must be transparent, proportionate, and aligned with customer expectations [11].

Behavioral data form the foundational input of the Digital Customer Intelligence Loop because they supply the evidence from which customer understanding is generated. However, behavioral data do not create value automatically; they must be transformed through analytics, interpretation, and managerial routines that connect digital signals to customer-relevant action [7]. **Table 1** categorises the types and sources of behavioral data in digital customer environments.

Table 1. Behavioral Data in Digital Customer Management: Types, Sources, and Characteristics for Customer Intelligence

Behavioral data category	Typical digital sources	Main customer intelligence value	Key characteristics
Clickstream and navigation data	Websites, search paths, product pages,	Reveals attention, browsing intent,	High volume, time-stamped, granular, real-time

	landing pages, session logs	journey friction, and content relevance				and service needs		
Transaction and purchase data	E-commerce systems, point-of-sale systems, subscription records, loyalty programs	Reveals actual purchase behavior, category preference, price response, and repeat buying	High value real behavior revenue		App usage and platform engagement data	In-app behavior, feature usage, time spent, frequency of return, notifications	Reveals habit formation, feature value, and engagement depth	Continuous user behavior analysis
Social media and user-generated data	Reviews, comments, shares, likes, ratings, influencer interactions	Reveals sentiment, advocacy, peer influence, and community engagement	Rich in data and significant insights		IoT and connected-device data	Smart devices, connected products, sensors, usage logs	Reveals product usage, context, maintenance needs, and service opportunities	Continuous automated behavior prediction
Mobile and location data	Mobile apps, geofencing, push notification responses, device-based interactions	Reveals proximity, contextual relevance, mobility patterns, and moment-based needs	Context sensitive useful for personalization		Personalization Capability Personalization capability is the organizational ability to convert customer data into tailored products, content, recommendations, communications, prices, services, and experiences. It includes data infrastructure, analytical models, decision rules, experimentation routines, and customer-facing execution systems that allow firms to act on behavioral intelligence [4]. In this sense, personalization capability is broader than recommendation technology because it combines technical systems with marketing judgment and strategic alignment. Artificial intelligence has intensified the strategic importance of personalization by enabling firms to detect patterns across large-scale behavioral data and automate adaptive customer interactions. Research on AI in service explains that intelligent systems can support mechanical, thinking, and feeling tasks, allowing firms to automate routine personalization while augmenting human understanding in more complex service contexts [3]. Similarly, machine learning in marketing connects computational power with human insight by identifying patterns that can improve targeting, prediction, and decision-making [12]. Personalization capability also depends on dynamic organizational capabilities rather than technology alone. Big data analytics research shows that firm performance benefits emerge when analytical resources are combined with sensing, seizing, and reconfiguring capabilities that			
Recommendation response data	Product recommender systems, content feeds, email offers, personalization engines	Reveals relevance, preference refinement, and response to tailored options	Directly related to personal learning					
Service interaction data	Chatbots, contact centers, service tickets, digital support journeys	Reveals pain points, satisfaction risks, problem resolution patterns,	Often contains behavioral textual emotional signals					

allow firms to adjust decisions as markets and customer behavior change [7]. The digital marketing capabilities gap further suggests that many firms fail not because personalization tools are absent, but because marketing, analytics, technology, and organizational processes remain insufficiently integrated [13].

In the Digital Customer Intelligence Loop, personalization capability performs the transformation function by turning behavioral data into customer-facing relevance. This transformation requires reliable data access, model interpretability, real-time execution, privacy safeguards, and coordination between technical and managerial actors [14]. Table 2 outlines the dimensions and enablers of personalization capability.

Table 2. Personalization Capability Dimensions: Technology, Data, Analytics, and Organizational Enablers

Personalization capability dimension	Core function in the loop	Required enablers	per
Customer data integration	Combines behavioral signals into a usable customer view	Customer data platforms, identity resolution, cross-channel data architecture	Un jo r
Behavioral analytics	Converts customer actions into interpretable patterns	Predictive analytics, machine learning, experimentation, attribution models	Pro ch
Real-time decisioning	Delivers timely and context-sensitive personalized responses	Decision engines, automation rules, low-latency systems, trigger logic	F off c r rec
Recommendation intelligence	Matches customers with relevant products,	Collaborative filtering, content-based models, hybrid recommenders,	rec s co

	services, or content	feedback learning	
Experience orchestration	Coordinates personalization across customer journey touchpoints	Journey mapping, omnichannel systems, service design, interaction governance	we ap pe
Privacy and trust governance	Ensures personalization is acceptable, transparent, and responsible	Consent management, privacy-by-design, explainability, data minimization	t rec cc
Organizational alignment	Links personalization to strategy, brand, and performance objectives	Cross-functional teams, marketing-analytics collaboration, executive sponsorship	Pe ro rou
Learning and optimization routines	Uses response data to improve future personalization	A/B testing, uplift modelling, feedback dashboards, model monitoring	e re offe a

Customer Engagement Mechanisms

Customer engagement is the behavioral and psychological response that emerges when customers perceive personalized interactions as relevant, useful, and worth continuing. Engagement research distinguishes customer engagement from simple purchase behavior because engaged customers may also pay attention, interact, share, advocate, co-create, and provide feedback that extends beyond immediate transactions [5]. In the Digital Customer Intelligence Loop, personalization becomes valuable when it activates these engagement responses rather than merely exposing customers to more targeted messages.

Personalization can strengthen engagement through three primary mechanisms: relevance, convenience, and

emotional connection. Relevance reduces cognitive effort by presenting customers with content, products, and services that match their interests, needs, or context, while convenience improves the ease and timing of customer decisions [15]. Emotional connection emerges when personalized experiences make customers feel recognized, understood, or supported, which is especially important in digital environments where technology can otherwise feel impersonal [16].

Digital content and engagement research suggests that personalization can also build trust and perceived value when customers experience tailored interactions as informative rather than intrusive. Content that is timely, useful, and aligned with customer goals can increase attention, deepen involvement, and support longer-term relational engagement [17]. Strategic engagement marketing further shows that firms should design engagement not only as a communication outcome but as a managed customer response process that links firm actions to customer participation [18].

Engagement outcomes can be cognitive, affective, and behavioral, and each form contributes differently to the loop. Cognitive engagement appears in attention, learning, consideration, and information processing; affective engagement appears in enjoyment, trust, attachment, and emotional resonance; behavioral engagement appears in clicks, repeat visits, purchases, reviews, referrals, and advocacy [19]. Table 3 summarises customer engagement mechanisms driven by personalization.

Table 3. Customer Engagement Mechanisms in the Digital Customer Intelligence Loop: Pathways from Personalization to Engagement Outcomes

Personalization-driven mechanism	How it activates engagement	Main engagement dimension	Typical outcome
Relevance enhancement	Aligns offers, content, or recommendations with customer needs and interests	Cognitive engagement	Click rate, view, product depth, referral
Convenience improvement	Reduces effort, search cost, and decision friction	Behavioral engagement	Share to profile, repeat

	across digital journeys		abandonment, fast conversion
Emotional recognition	Makes customers feel understood, valued, or individually acknowledged	Affective engagement	Satisfaction, feedback, social proof, referral, repeat interaction
Contextual timing	Delivers personalized interaction at a relevant moment or location	Cognitive and behavioral engagement	Not relevant, time offer
Interactive participation	Invites customers to respond, configure, rate, review, or co-create	Behavioral engagement	Repeat purchase, upsell, cross-sell, advocacy
Trust-building personalization	Uses transparent, responsible, and useful personalization practices	Affective engagement	Conversion, price sensitivity, reduced risk
Experience continuity	Coordinates personalization across channels and journey stages	Cognitive and affective engagement	Click rate, repeat purchase, journey completion
Advocacy stimulation	Converts positive personalized experiences into public recommendation	Behavioral engagement	Repeat sales, testimonials, generate content

Business Performance Outcomes

Customer engagement contributes to business performance because engaged customers are more likely to buy repeatedly, respond to offers, remain loyal, recommend the firm, and provide data that improves future marketing decisions. Customer engagement strategy research argues that engagement must be connected to firm-level objectives rather than treated only as a communication metric [20]. In this article, engagement is conceptualized as the bridge between personalized customer experience and measurable performance outcomes.

Performance outcomes include financial indicators such as revenue growth, profitability, customer lifetime value, share of wallet, and reduced acquisition or retention costs. They also include customer-based indicators such as satisfaction, loyalty, advocacy, trust, and reduced churn, which often mediate the relationship between engagement and financial results [21]. This distinction matters because engagement may improve business performance indirectly over time rather than immediately through a single transaction.

The link between engagement and performance is contingent on industry context, competitive intensity, customer segment, platform dependence, and the quality of the personalization experience. In retail settings, predictive analytics and personalized decision-making may improve assortment, targeting, and customer response, but performance gains depend on execution quality and customer acceptance [2]. Broader digital transformation research similarly shows that firms benefit when digital investments are aligned with strategy, organizational capabilities, and customer value creation rather than implemented as isolated technologies [22].

Performance outcomes also feed back into the loop by showing which engagement patterns generate value and which do not. For example, high click-through rates may appear positive but may not produce revenue, loyalty, or satisfaction if customers experience personalization as manipulative or irrelevant after the initial click [23]. **Table 4** links customer engagement to business performance outcomes.

Table 4. Business Performance Outcomes from Digital Customer Engagement: Metrics, Linkages, and

Contingencies			
Engagement outcome	Related business performance metric	Performance pathway	Main contingency
Higher attention and interaction	Click-through rate, page depth, time spent, app sessions	Increases opportunity for conversion and learning	Content relevance, journey design
Repeat purchase behavior	Revenue, repurchase rate, customer lifetime value	Converts engagement into recurring economic value	Product quality, price fairness, switching costs
Reduced churn	Retention rate, subscription renewal, customer lifetime value	Preserves existing customer relationships and reduces replacement costs	Service reliability, and competitive alternatives
Advocacy and referral	Referral rate, social sharing, review volume, earned reach	Extends customer value through network effects	Trust, satisfaction, social influence
Satisfaction and trust	Net promoter score, satisfaction score, complaint reduction	Improves willingness to continue interaction and share data	Privacy perception, experience consistency
Cross-sell and up-sell response	Basket size, category expansion, share of wallet	Uses engagement knowledge to deepen customer value	Recommendation accuracy, perceived value

Service participation	Self-service completion, feedback submission, issue resolution	Reduces service cost and improves experience learning	Ease of use, customer capability
Data-sharing continuity	Consent retention, preference updates, opt-in behavior	Maintains access to behavioral data for future personalization	Transparency and privacy governance

Proposed Digital Customer Intelligence Loop

The Digital Customer Intelligence Loop is proposed as a dynamic conceptual model connecting four components: behavioral data, personalization capability, customer engagement, and business performance. Behavioral data provide the input layer, personalization capability transforms those inputs into tailored experiences, customer engagement reflects the customer response, and business performance captures the value outcome. The model extends linear data-driven marketing views by arguing that engagement generates additional behavioral data, which then re-enters the system and improves subsequent personalization [1].

The loop begins when firms collect behavioral signals from digital interactions and convert them into customer intelligence. Personalization capability then applies analytics, artificial intelligence, and managerial decision rules to produce relevant content, recommendations, offers, and experiences [24]. When customers respond through attention, interaction, purchase, advocacy, or feedback, those responses become new behavioral data that refine future customer understanding.

The model is self-reinforcing only when the feedback process is deliberate, governed, and strategically aligned. If engagement data are captured but not integrated, the loop breaks at the data layer; if analytics are strong but organizational alignment is weak, the loop breaks at the personalization layer; if personalization increases exposure but not relevance, the loop breaks at the engagement layer [13]. Research on social media marketing strategy also suggests that digital customer interactions must be

embedded in coherent strategic choices rather than treated as disconnected platform activities [25].

The Digital Customer Intelligence Loop therefore describes both a value-creation mechanism and a diagnostic framework. It clarifies how firms can move from data accumulation to customer learning, from personalization tools to personalization capability, and from engagement metrics to business performance management [26]. Table 5 presents the complete Digital Customer Intelligence Loop model with its components and feedback dynamics.

Table 5. Digital Customer Intelligence Loop Model: Components, Relationships, and Feedback Mechanisms

Loop component	Conceptual role	Main organizational requirement	Primary outcome
Behavioral data	Input layer of customer intelligence	Data capture, integration, quality control, consent management	Customer journey, personalization
Customer intelligence interpretation	Sense-making layer between data and action	Analytics expertise, customer insight routines, model interpretation	Customer segmentation, prediction
Personalization capability	Transformation layer of the loop	AI/ML models, decision engines, experience design, organizational alignment	Tailored content, recommendations
Personalized experience delivery	Customer-facing execution layer	Omnichannel coordination, timing, relevance, interface quality	Individualized digital experience
Customer engagement	Behavioral and psychological response layer	Engagement design, trust-building, interaction opportunities	Active participation, feedback, advocacy

Business performance	Value outcome layer	Performance measurement, attribution, strategic monitoring	Retention, profitability, customer loyalty
Governance and trust	Boundary condition across the loop	Privacy safeguards, transparency, fairness, responsible data use	Customer willingness to interact
Continuous learning	Dynamic feedback mechanism	Experimentation, model monitoring, cross-functional review	Iterative personalization and adaptation

Figure 1 presents the Digital Customer Intelligence Loop as a dynamic feedback model linking behavioral data, personalization capability, customer engagement, and business performance.

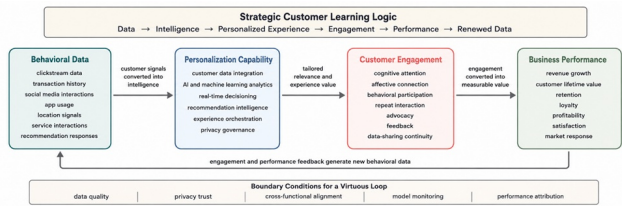


Figure 1. The Digital Customer Intelligence Loop: A Dynamic Feedback Model of Data-Driven Customer Value Creation

Application to Digital Business Strategy

For digital business strategy, the loop helps managers prioritize investments according to where the customer intelligence system is weakest. A firm may possess large volumes of behavioral data but lack integrated profiles, or it may have advanced recommendation tools without sufficient engagement design or privacy governance [27]. The model therefore encourages managers to evaluate the whole system rather than investing narrowly in data infrastructure, AI tools, or campaign automation.

The loop can be applied in retail, platform, subscription, and service contexts. A digital retailer can use browsing and transaction data to personalize recommendations,

observe engagement through click-through and purchase behavior, and then refine future offers based on conversion and retention outcomes [28]. A subscription platform can use app usage and churn signals to personalize content, improve engagement continuity, and strengthen customer lifetime value through learning from repeated interaction patterns [29, 30].

Strategically, the Digital Customer Intelligence Loop also clarifies why personalization must be aligned with customer experience rather than only short-term conversion. New technologies can transform customer experience by enabling more responsive, interactive, and context-aware encounters, but these benefits depend on whether customers perceive the interaction as helpful and trustworthy [15]. When firms design the loop around long-term customer value, personalization becomes a strategic capability rather than a tactical communication technique [24].

Research and Managerial Implications

For researchers, the model generates testable propositions about feedback dynamics in digital customer management. Future studies can examine whether firms with stronger feedback integration between engagement data and personalization systems achieve higher customer lifetime value than firms using personalization in a static or campaign-based manner [31]. Researchers can also test whether privacy trust moderates the relationship between behavioral data collection and engagement, especially when personalization depends on sensitive or continuous data flows [11].

The model also invites research into thresholds, delays, and failure points in customer intelligence systems. It is possible that personalization improves engagement only up to a point, after which customers experience fatigue, surveillance concerns, or reduced autonomy [16]. Research on consumers and artificial intelligence suggests that customer reactions depend not only on technical accuracy but also on experiential perceptions of control, agency, and appropriateness [16].

For managers, the model provides a diagnostic tool for identifying loop weaknesses. If behavioral data are abundant but engagement is weak, the problem may lie in relevance, timing, or experience design rather than data

availability [17]. If engagement is strong but performance does not improve, managers may need better attribution, customer lifetime value measurement, or strategic alignment between engagement metrics and financial outcomes [20].

The managerial implication is that firms should build a culture of continuous customer learning. This requires cross-functional collaboration among marketing, analytics, information systems, product teams, service managers, and privacy leaders [14]. Collaborative artificial intelligence in marketing further suggests that the most effective systems will combine automated intelligence with human judgment, enabling firms to learn from customers while maintaining strategic control and ethical responsibility [29].

Figure 2 translates the Digital Customer Intelligence Loop into a managerial diagnostic framework for identifying where data-driven customer value creation breaks down.

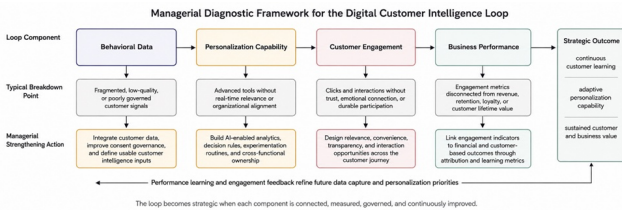


Figure 2. Managerial Diagnostic Framework for Strengthening the Digital Customer Intelligence Loop

Conclusion

This article proposed the Digital Customer Intelligence Loop as an original conceptual model for understanding how firms can create value from behavioral data, personalization capability, customer engagement, and business performance. The model argues that these elements should not be managed as isolated functions or as a one-way sequence. Instead, they form a dynamic loop in which customer responses continuously improve future customer intelligence.

The central contribution is the feedback logic. Behavioral data become valuable when transformed into personalization capability, personalization becomes valuable when it strengthens engagement, and engagement becomes strategically valuable when it improves performance while generating new data for continued learning. The loop therefore explains why firms may collect extensive customer data yet still fail to achieve sustained customer and business value.

The Digital Customer Intelligence Loop encourages firms to move beyond linear thinking in digital customer management. It positions customer intelligence as a continuous strategic capability that depends on data quality, analytical competence, engagement design, performance discipline, and responsible governance. Future research can empirically test the loop, while managers can use it to build more adaptive, customer-centered, and performance-oriented digital business strategies.

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