

# The Role of Generative AI in Enhancing Customer Experience and Risk Management in Credit Card Services

Abhishek Dodda<sup>1</sup>

<sup>1</sup> Engineering Manager, Centific.com

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## Abstract

To reduce expenses and increase profitability, it becomes increasingly important for credit card service providers to meet the increasing Customer Experience (CX) demands of the market. Businesses are positively influenced by an improved CX and are less likely to switch service providers. Simultaneously, credit card service providers are exposed to a high amount of risk and face continuous changes and re-developments in their service offers. Using Generative AI (G-AI) in Customer Experience Management (CXM) can help to improve the complete customer life-cycle, thus enhancing the business performance and further supporting service providers in their risk management. This work aims to present insights about the overall role of G-AI in CXM research to provide a more profound understanding of what the technology can contribute to CXM in credit card service companies. Four specific areas of action related to G-AI improvements in CXM have been identified: enhancing customer knowledge, creating customer engagement and loyalty, supporting customer relationship management, and improving CX data management.

G-AI can sustainably enhance CXM in credit card service companies. The generated insights reveal what actors should take into consideration when deciding to use the technology to assist CXM at both strategic and operational levels. We discuss the benefits and challenges connected to the decision-making process concerning the use of G-AI in businesses and thus derive propositions for future research in the area. To extend the insights, we further combine the G-AI and CXM research areas and thus contribute additional insights with our interdisciplinary work. The insights presented in this work can be used by practitioners from different industries to support intrand interdisciplinary decision-making and strategizing for UXM on the strategical and operational levels.

**Keywords:** *Credit Card Services, Customer Experience Management, Generative AI, Customer Lifecycle, Business Performance, Risk Management, Customer Knowledge, Customer Engagement, Customer Loyalty, Relationship Management, CX Data Management, Strategic Decision-Making, Operational Efficiency, Interdisciplinary Insights, Technology Integration.*

## I. INTRODUCTION TO AI IN FINTECH

What is the motivation behind your study? Why do you think the study is important? Why have you chosen the specific institution you have? What is your research question?

The proliferation of credit cards set in motion manifold transactions between users and service providers, bringing along a strong demand for frictionless user experiences. However, abusing this ease of use, cybercriminals emerged

with disruptive activities intended to mine illegal user information. Affected by invisible crimes, services began investing in risk management strategies, designed to mitigate losses from such events. Cybercriminals, though, have invested in continuously improving their techniques. Consequently, at the vanguard of customer service, financial organizations have recently adopted machine learning and deep learning methods to enhance customer experience and risk management. More specifically, Generative Adversarial Networks and Vision Transformers techniques are being

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used to generate simulated data from image-based and transactional-based networks to enhance credit card services.

This research study aims to understand how credit cards maximizing customer experience and minimizing risks associated with customer transactions have leveraged GAN and ViT strategies to obtain efficient, effective, and error-free results. To achieve this aim, the research question, “How can GAN and ViT strategies optimize for risk management and customer experience in credit card services?” was developed. Ultimately, in what follows, we

present a review of the literature to establish the current state of credit card services implicitly adopting GAN and ViT strategies. Next, we present the topic of generative adversarial networks, as well as brief approaches to demonstrate how GANs are leveraged in credit card services. The same is done for ViT. Following this, credit service strategies are then discussed to demonstrate how for customer experience and risk management GAN and ViT can optimize credit card services. Finally, we close this work by discussing the future limitations and directions of this study.



Fig 1 AI in Credit Risk Management

## II. OVERVIEW OF THE STUDY

This study explores how generative artificial intelligence technologies impact customer experience and risk management within credit card services. It begins with an overview of the landscape of the credit card sector, focusing specifically on customer experience and risk management, before contextualizing these issues with respect to generative AI. It concludes with a discussion of the findings and an outlook on future possible research directions.

Generative AI, chatbots, in particular, have quickly become significant technological enablers, triggering disruptions to a variety of sectors. Their chatbot-like configurability creates opportunities for transforming background processes and fundamental service building blocks such as risk management in credit card services, allowing organizations to rethink and rebuild value propositions. Customer service, allows companies to develop chatbots to assist customers with their general inquiries for credit cards and anything related during any particular moment, while risk management, allows automating aspects of the customer onboarding process by validating customer data, fraud risk detection engines to help analyze and tag, score, and detect potential fraud chargeback scenarios, would both significantly benefit from the application of these technologies.

This study examines how two key credit card service activities, customer service and risk management, are impacted by the innovations of generative AI technology. It builds on design and socio-technical information processing perspectives to leverage insights around risk management to build a bridge toward customer experience. To structure the analysis, it first contextualizes the credit card industry and then provides further concepts for AI agents and assistants. It concludes with a discussion of the implications for academics and practitioners.

## III. UNDERSTANDING GENERATIVE AI

### ➤ Definition and Overview

Artificial intelligence (AI) has electricity. In other words, we are finally wiring the world in a way that makes it possible to use it for all kinds of amazing things, for example, generative models give AI the ability to change not just how we think about intelligence, but its practical application in the world as well. Generative AI is a branch of AI that creates new content such as music, text, images, and videos based on the data it was trained on thanks to algorithms and techniques known as generative models. These models don't just analyze and optimize – They generate new content based on existing content, changing the game for everything from fashion design to gaming. GPT-3 isn't all that different from a piece of music generation software or a neural net generating images – They are all generative models following rules set by humans but applying them to create something new. What makes GPT-

3 so unique is the sheer amount of data processed, and its use of something called a transformer architecture to achieve its impressive scale. It's powered by an AI technology called reinforcement learning with human feedback. In essential terms mixing three elements – a world model, a learning objective, and a reinforcement signal – allows us to build systems capable of guiding a wide range of decision-making processes with very little prompting.

➤ *Key Technologies and Techniques*

Generative modeling is an unsupervised learning technique that estimates the joint probability distribution of the input data, unlike discriminative models which model the conditional probability of a target output given an input. Generative models can learn a manifold of the input data, which is useful for various interrogation tasks. As underlying high-dimensional data distributions are complex and often intractable, the goal of generative models is to learn a good approximation of these data distributions. Generative models are capable of generating new samples that are representative of the data distribution given a small number of labeled data points and typically make two key assumptions; the data lies on a lower-dimensional structure embedded in a higher-dimensional space, and the distribution of the data samples can be approximated by a parametric function.

➤ *Equation 1 Personalized Offer Generation Score*

$$P_o = f(C_p, B_h, T_c; \theta)$$

Where

$P_o$ : Personalized Offer Score

$C_p$ : Customer Profile (age, income, preferences)

$B_h$ : Behavioral History (spending, repayment habits)

$T_c$ : Transaction Context (merchant type, time, location)

$\theta$ : Model Parameters (e.g., weights in a transformer-based model)

➤ *Definition and Overview*

To make intelligent decisions, businesses need capabilities to analyze data and model complex systems. The current generation of AI can analyze big data at scale, spot patterns hidden from human experts, and make precise predictions by learning from black-box models. Generative AI optimizes this process by generating predictive models that are often flatter, smaller, and more interpretable than the black-box models. Unlike traditional AI, which is constrained to discriminate between outputs based on decision variables, generative AI can create entirely new inputs which makes it possible to analyze cases that do not currently exist, such as novel products that no consumers know about and policy changes that haven't yet occurred.

Generative AI allows companies to envision the future with simulated realistic scenarios. Instead of merely predicting downturns like current implementations of AI, generative AI can create different transitions by altering

variables from a specific distribution and making more precise predictions. The models are not necessarily more accurate than standard predictive models, but improve future projections and scenario analyses, helping with far-sighted risk-awareness, financial and strategic planning, innovative product development, and Mergers and Acquisitions. They are more interpretive than typical supervised or unsupervised predictive models and they are costless, extremely fast, and can cover dozens of macro and strategic factors at once. Generative AI produces artificial inputs, including diversified or extreme scenarios, which can provide better answers on financial risk management, such as stressed capital adequacy and asset pricing under different transition patterns, or corporate strategy, such as what-if analysis of synergistic effects from M&A.

➤ *Key Technologies and Techniques*

One of the key technologies of recent generative models is Transformer architecture, coming originally from the machine translation domain. It presented an architecture favorable to efficiency and scaling, with fast parallel training, thanks to the attention mechanism, allowing for a long-range context. It is a simple architecture with only feedforward ResNets brick and layer normalization block, stacked with many layers and huge dimensionality, trained on self-supervised tasks with large amounts of data, that resulted in outstanding performance gains across many domains. The enormous progress of scaling performance with model size, amount of data, and training time, have pushed initial research efforts in the generative model domain outside of the increasingly popular mini- and mid-tuning approach. If scaling is feasible, it is thus easier to start from scratch and train large models on self-supervised tasks – this is the reason behind many of the current large generative models.

Generative AI also encompasses generative models that implement some generative tasks, but that are not trained solely through a generative objective. For instance, the powerful but notorious model is trained with a discriminative objective. More recently, several of the best-performing generative models released by various actors are obtained via a combination of generative and discriminative training. While prompt-based transfer has also been very successful in Natural Language Processing and the zero-shot transfer of vision tasks with large vision models, such approaches are not focused on classical generative tasks, nor are they always the best approach for generative tasks. Generative AI is a broad tag that currently describes very different domains of work and various levels of development. It comprises some other techniques than the few discussed here, such as Neural Radiance Fields for 3D object generation and other multi-modal models, that support text-to-audio tasks, like music generation.

#### IV. CUSTOMER EXPERIENCE IN CREDIT CARD SERVICES

##### ➤ *Current Trends and Challenges*

Customer experience is at the epicenter of the ever-expanding credit card industry. Currently accounting for over 22 billion dollars in revenue and projected to grow by nearly 12% every year, the expansion of the credit card business has created both opportunities and risks for the players in the industry, as fierce competition drives companies to innovate and engage with their customers. As a result, customers are continually inundated with promotions and marketing communications from a variety of sources, and receiving a poor experience with one company makes them that much more likely to sever their long-term bonds with that brand and choose – instead – a competitor offering them a different experience.

Connecting with multiple stakeholders among business delinquents, average customers hoping for approval, and profitable customers demanding added perks drive complexity in the decision journey, particularly for premium credit cards. All in all, performing a simple task such as checking a balance on an app may seem simple and easy until you realize that you have 15 apps on your phone but cannot check the balances on half of your cards because the login and password requested do not match what you have entered.

##### ➤ *Importance of Customer Experience*

Customer experience is quickly becoming the new battleground for loyal customers. Companies seeking to capitalize on consumers’ increasingly digital behaviors are presently using technology to develop new digitally focused communications tools to engage and support customers, and then leveraging their physical network for in-person customer service. In an industry known for over-complicated products and hidden fees; esoteric and bewildering contracts; and frustratingly long and painful sign-up processes; improved customer experiences are being viewed as a source of differentiation and competitive advantage. The best companies are elevating the customer service experience by handing every employee decision-making authority to help resolve customer issues wherever they occur.

Strategies being adopted include providing multiple channels for consumers to communicate and work with the bank, anywhere and anytime including digitally via email newsletters, push notifications, phone apps, and social media. Upgrading contact centers through rounds of continuous training and specialized staff to improve transaction accuracy and speed of servicing their customers while listening actively during each interaction to provide a personalized experience; and deploying customer relationship management tools to send proactive communications, such as reminders and alerts.

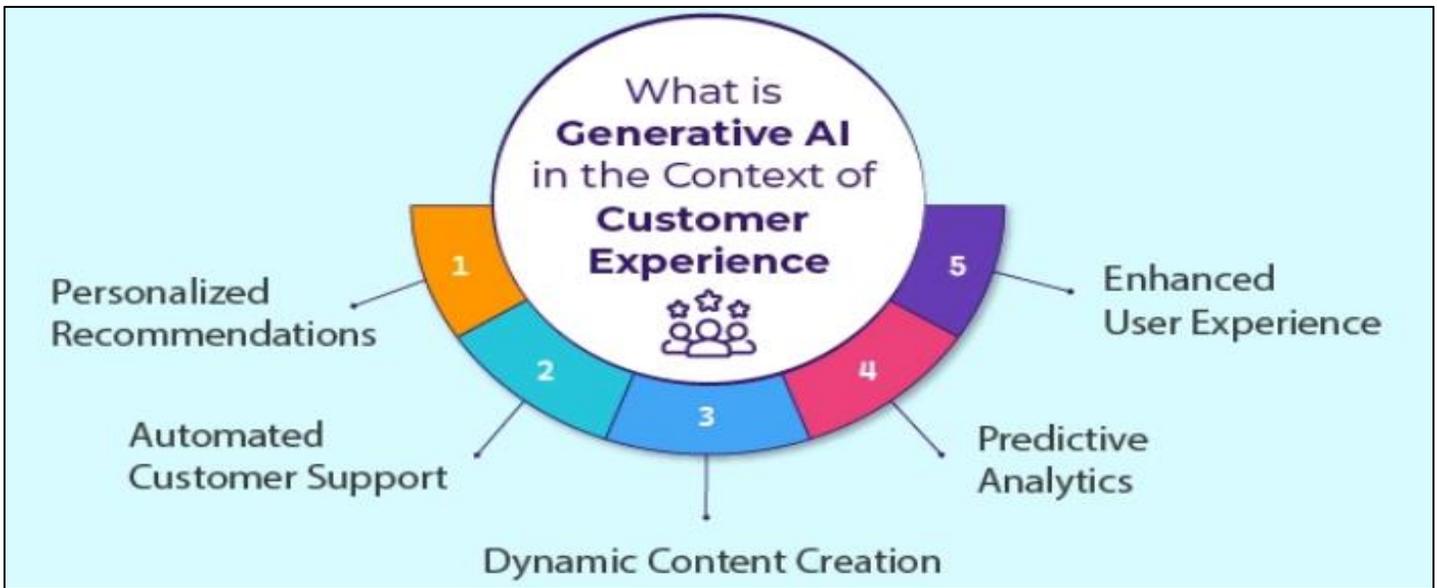


Fig 2 Generative AI for Customer Experience

##### ➤ *Current Trends and Challenges*

Customer experience has received significant attention, especially in the payment industry, with the advent of newly emerging technologies such as contactless payments and digital wallets. As serving customers becomes easier for banks with the availability of digital interfaces, giving customers an easy time goes a long way in promoting various services across the value chain, thereby boosting

their share of wallet. However, achieving a good customer experience with credit cards is fraught with several challenges. Not only do credit card issuers have to offer differentiated products while keeping an eye on competitive pricing, but they must also ensure that they meet the expectations of customers at every stage. Beyond product design, customer service plays an important role in determining the experience of customers as they navigate

through various processes, such as getting customer support to resolve a payment failed issue, dispute a transaction, or increase their credit limits.

Some recent trends in customer experience with credit cards are the need for faster payments and an increase in the use of mobile payment solutions. Customers are looking for seamless access and use of accounts, easier navigation through processes, early access to information such as fraud alerts, availability of multiple support channels, and more. On the flip side, challenges such as security, account and identity theft, insufficient offerings, and technology infrastructure remain. Able to process huge amounts of data, Generative AI can help banks address many of the challenges in achieving a good customer experience, and to further augment the efforts to address the trends mentioned earlier. For instance, Generative AI can help banks offer personalized products, conduct faster credit assessment checks, offer multi-channel and multi-dimensional support, and send alerts in real-time to account holders.

➤ *Importance of Customer Experience*

Customer experience describes all aspects of a customer's interaction with a company or a brand. A good customer experience results in a strong relationship between the customer and the brand, while a poor consumer experience results in less trust and loyalty to the brand. For service-based industries, such as credit card services, consumers are continually trying to assess the quality of services received. Credit card services are intangible, and thus consumer perceptions of credit card service quality will influence their overall evaluation of the service. As the service is used continuously throughout the consumer's life cycle, negative experiences may lead to the consumer diversifying their card usage to include competitors, and this could eventually lead to the consumer abandoning their use of that credit card altogether. Poor customer experience in credit card services opens the customers up to better offers, be it incentives or low fees, from competitors, which can serve as an attraction point for the consumers.

While disruptions stemming from the pandemic have posed a plethora of challenges in the banking sector, it has also driven significant changes in consumer needs and behaviors. A growing pool of digital-savvy consumers is seeking new banking experiences that are powered and driven by technology, convenience, and safety, making it imperative for financial institutions to reimagine their service offerings. Industry players are actively investing in developing digital payment capabilities and technology-enhanced service delivery to retain existing clients. Besides the aforementioned increased competition and changes in consumer behavior and needs, the proliferation of fintech has also fragmented the credit card services landscape, and will undoubtedly put pressure on industry players to focus efforts on improving their customer experience quality while continuing to innovate in terms of the product offering.

## V. APPLICATIONS OF GENERATIVE AI IN CUSTOMER EXPERIENCE

A wide variety of Generative AI solutions have shown a remarkable capability of generating text, images and other content upon prompts. A large number of companies have started to adopt these tools internally. We present a few examples of what has already been implemented in terms of enhancing customer experience in the credit card industry.

➤ *Personalized Customer Interactions*

Generating personalized experiences for customers has been a marketing goal for many years. Many organizations examine the historical interactions that each customer has had across all their touchpoints to build customer segments. Customized product availability and promotional offers exist based on those segments, or sometimes for specific customers using implicit or explicit preferences. Generative AI tools can generate promotional offers, email templates, websites, and other assets using each person's preferences or segment profile.

Generative AI tools can help with the content creation for campaigns, reducing the time to turn around on campaigns. Content can be generated in the customer's language of choice, based on the person's past interactions with other brands. Existing campaign management tools may need to be enhanced to incorporate Automating Productions Generative AI capabilities of creating email templates, social media posts, landing pages, and even personalized dynamic email content in real-time would further push the boundaries of what can be personalized.

➤ *AI-Driven Customer Support*

Adopting Generative AI tools to support customer questions is a natural alignment with the capabilities of these tools. The Generative AI credit card implementation example captures a customer's intent through its conversational and contextual understanding capability and performs many actions to resolve the customer's issue. Generative AI systems have been trained on abundant customer-facing data: official credit card operational documents; credit card public-facing websites offering knowledge bases; and transcriptions of historical customer service interactions.

➤ *Personalized Customer Interactions*

Personalization of customer interactions is the most important and common use case of generative AI in enhancing customer experience in credit card services. Generative AI models are capable of performing several personalization functions such as drafting personalized emails at scale, generating personalized digital communication messages, and creating personalized digital advertisement campaigns. NLP and LLMs tools are used for email drafting. Text and voice assistant tools are used for

creating messages for text and voice-based chatbot interfaces. Generative AI tools are also used for deploying merchandise personalization tools to offer recommendations for fashion, jewelry, or merchandise purchases to cardholders and create supplementary services and discounts such as airline miles for affected cardholders. Another prominent use case of generative AI is the personalization of digital marketing for credit card issuers. Real-time data on customer purchase spending behavior is leveraged to create customer segments of credit card issuers for personalized promotional campaigns based on a preview of predicted purchases in the next month.

Techniques such as vector-based embedding and similarity matching can be used for customer segmentation. A generative AI model can be used to create and generate a campaign and its components such as email subject lines, email content, visuals, and customized landing pages that would drive high conversion rates based on each customer segment. Similar generative AI models can also be used for developing marketing and promotional strategies. Further, the topical relevance model can be used for module specification concerning promotional spend campaigns or for predicting content engagement for optimization of the campaign. Generative AI models can also be used for creating synthetic marketing data for unseen customer groups in the future.

#### ➤ *AI-Driven Customer Support*

Natural language processing technology is transforming customer interactions for banks and payment providers. Generative AI solutions enable 24/7 support, allowing customers to receive answers immediately, in whatever language they prefer, from any device, on any payment-related topic. AI-fueled chatbots are being used on major payment provider websites and in popular mobile apps to address customer concerns with instant assistance. Customers can ask about their choices, and technology interprets, translates, and responds in near-real time, in any language, eliminating language barriers. AI capabilities are being integrated into voice support as well, collecting input and enabling rapid, accurate customer assistance, streamlining multichannel support. When customers are combined into groups with shared practices or specific needs, banks can provide unique offers. This entails using data analytics for various processes, such as predicting high-value customers and deciding when to use email or social media communications.

Of note, AI chatbots enable self-service help that comes at a lower cost. If, for example, a bank helps a user reset their password through a chatbot, that would cost a fraction of the cost of assisting in a call center. It's not just a matter of eliminating costs, though; when people can use a messaging service to receive customer service without being on hold for 45 minutes, they're happier. Plus, AI can collect additional pockets of data and insights that lead to a more personalized experience. A user might ask questions about the weather as part of a back-and-forth interaction, and the chatbot then

uses that insight to personalize other marketing communications, such as emails highlighting offers from a bank partner.

#### ➤ *Feedback Analysis and Improvement*

Continuous improvement of the customer experience is paramount for credit card services, particularly with the amount of feedback they generate and their use of marketing techniques like cross-selling. Solicitations through deceptive techniques can lead to customer action that results in regulatory scrutiny and possible significant ongoing consequences. Firms collect myriad amounts of customer interactions through reviews on social media posts, reviews of services on competitive websites, complaint records, and direct comments and reviews of the firm. The credit market can be especially sensitive to negative actions by players, as seen by the effects of the financial crisis. Negative credit card service actions can quickly spread virally, particularly with the modern use of social media techniques.

Generative AI techniques, and in particular large language models, lead to unique opportunities to efficiently summarize feedback data and help credit card firms devise targeted marketing responses. Large language models alleviate some of the data problems associated with prior machine learning algorithms used to analyze customer feedback because these text models do not rely on delicate parsing or cleaning techniques, but rather can effectively process conjunctions, negations, and similar issues common in human communication. We discuss four types of capabilities that LLMs can provide to customer feedback analysis above prior text mining techniques and technologies. First, LLMs can perform zero-shot data labeling or classification tasks. Second, LLMs can summarize customer unhappiness. Third, LLMs can productively annotate and cluster data. Fourth, LLMs can automate previously tedious response generation. While a firm may not need to implement all LLM capabilities, the availability of multiple different tools can allow products' responses to reflect the specific solution.

## **VI. RISK MANAGEMENT IN CREDIT CARD SERVICES**

Risk management is the process of identification, assessment, and prioritization of risks. This process is designed to ensure protection against risk by enabling organizations to develop and implement methods of controlling, mitigating, and transferring risks. Risk management is essential to the success of any business, given that risk is inherent in every business activity throughout the life cycle of credit card services. Comprehensive risk management is vital for the stability and soundness of credit card service providers. Given the various risks involved, risk management is an indispensable part of card service operations, as risks can create problems for any service provider. Credit card services also have relatively weaker risk management capabilities. Service providers

frequently do not allocate adequate resources to risk mitigation. As credit card services focus heavily on margins throughout the service life cycle, service providers can create problems in the market. If they undercut the pricing of their card services and rely on the underwriting discretion of banks, they are at an increased risk of incurring losses.

Credit card services are mainly plagued by several limitations about ending the prevalent association between credit transactions and risk. Credit transactions have been exclusively associated with risk on the part of credit card issuers. However, credit card fraud is a violation of the complete trust and confidence that the cardholder and the

merchant service establishments place in each other, who work in tandem to generate revenues. Thus, the present paradigm can be summarized in a simple statement: there is presently greater protection against losses for a cardholder than for a services merchant. Any prudent cardholder would not be willing to pay the small cost compared with the inconvenience of continued liability in potential associational fraud. Hence, credit transactions have to be associated both with the risk of the cardholder and the service establishment as well. This leads to the need for revisiting the structure of risk management in credit card services.

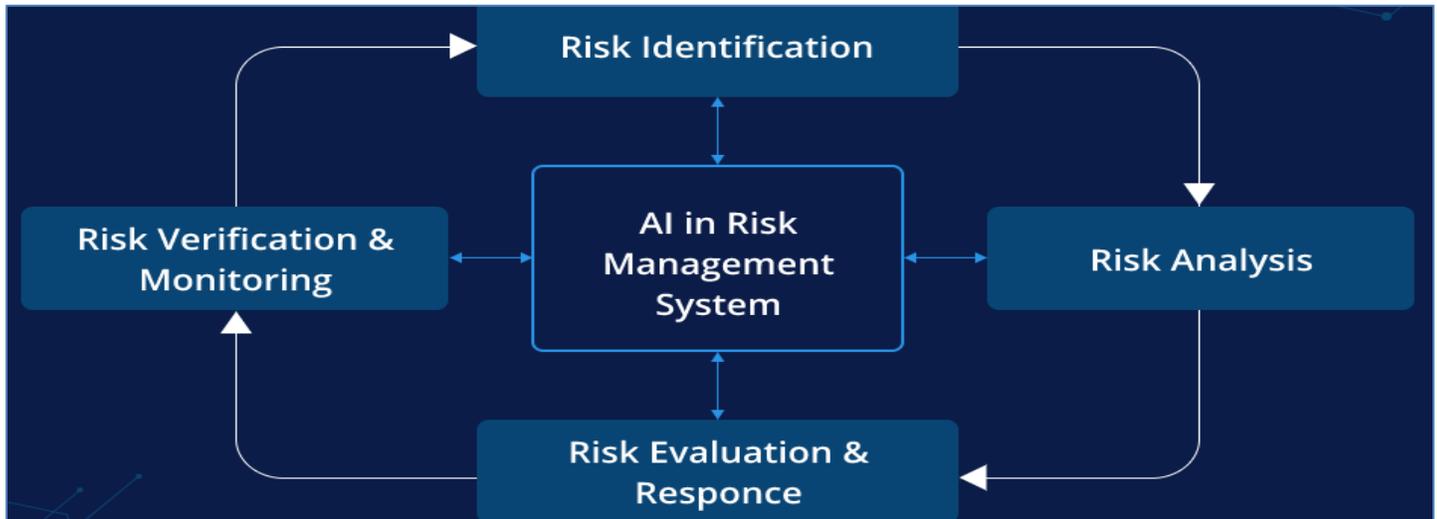


Fig 3 AI in risk management

➤ *Identifying Risks in Credit Card Transactions*

The convenience of credit cards has robbed many people of their sense of financial responsibility. Credit cards allow us to spend seemingly beyond our means, but this false sense of skilled management is erased when monthly statements reflect the reality of high-interest debt. It has not always been this way; a long time ago, credit was exceedingly rare, but then came business expansion after World War II and the demand for a better understanding of consumer patterns, a desire and need for better ways of spending, and a growing need for consumer credit. The first department store credit cards were introduced in the late 1800s. In the 1940s, the Diners Club card was developed. This was the first card that was close to what we have today. Servicing restaurants, the cards had an annual fee. Milano banks developed a travel and entertainment card that was chargeable, and Coca-Cola introduced a card that could be used to buy their products.

The original intention of credit cards was to enhance buying convenience. A cardholder's account is, for all practical purposes, an unsecured revolving credit loan made to the cardholder with the lender having some interest in the transaction. Banks remained passive about the rules of credit. Later, they bought accounts from other banks and merchants for whom they had provided services. Today,

credit card accounts are among the most highly desirable of any consumer credit. A high-yielding asset is currently in balance sheets alongside demand deposits, small-time certificates of deposit, and low-yield consumer installment loans. Credit cards are currently used for a variety of transactions like cash withdrawals, bill payments, and others. With the increase in credit cards, the volume of fraudulent transactions has also increased. These fraudulent transactions are resulting in significant financial losses for banks. This necessitates that the banks effectively identify the fraudulent transactions and save their financial losses. Therefore, it is important to understand that these bank customers who own credit cards face issues and risks like credit card fraud and identity theft.

➤ *Importance of Effective Risk Management*

Risk management plays an important role in financial institutions as it enables them to recover from losses incurred due to fraud, identity theft, terrorist financing, and cyber-attacks. Addressing the shortcomings of traditional credit card solutions, in terms of susceptibilities to high account takeover rates and card-testing fraud, identity theft, and higher risk of charge backs, card companies are developing innovative options for merchants and customers to ensure risk is mitigated. This not only helps create a seamless

customer experience while making payments but also protects card companies.

The traditional mode of risk management processes followed by credit card companies was often rudimentary, using checks and balances that can be easily rendered ineffective by the use of advanced technology by subtle attackers who are attempting phishing or hacking account information to make unauthorized online transactions. These hackers usually gain access to customer information by various means, such as keyloggers, malware, phishing, social engineering, and man-in-the-middle attacks. Addressing these types of attacks requires credit card processing companies to take additional measures while developing their software services. They have APIs in place that can be integrated into merchants' checkout pages at an added cost to ensure the integrity of customer credit card details.

➤ *Equation 2 Customer Sentiment Analysis for Experience Optimization*

$$S_c = \frac{1}{n} \sum_{i=1}^n \text{Sentiment}(r_i)$$

Where

$S_c$ : Average Customer Sentiment Score

$r_i$ : Individual Customer Feedback or Review

Sentiment( $r_i$ ): NLP-based Sentiment Output (e.g., from a BERT classifier)

## VII. GENERATIVE AI IN RISK MANAGEMENT

Generative AI is now being utilized in multiple dimensions of risk management across various industries, like central banking, capital markets, insurance and others. In the credit card sector, generative AI is used in fraud detection and prevention, credit scoring and risk assessment, as well as regulatory compliance and reporting. These use cases improve risk management across different aspects, including model performance and risk limits.

➤ *Fraud Detection and Prevention*

Generative AI techniques simulate fraudulent transaction data, creating realistic examples of fraudulent activity for analysis and testing. This enables the detection models to better differentiate between normal and fraudulent transaction behavior for cardholders engaged in legitimate transactions. In addition, fraud detection models call for continuous learning and adapting, as fraud patterns evolve with the introduction of additional payment channels and methods such as contactless payments, digital wallets, and account linking. Generative AI techniques craft synthetic data which enhances the data available for retraining monitoring models.

➤ *Credit Scoring and Risk Assessment*

Within the credit space, customer credit scores are typically driven by risk models for loss prediction, which estimate the probability of default associated with a customer who has a specific score. The back-end components of loss prediction models apply various techniques to predict expected credit risk. These risk models require historical customer data detailing their performance on the balance sheet that is used to train the models. As generative AI evolves, it can introduce a solution to address the limitations of data sparseness, since it can help create performance data for rare events to train models and improve their performance.

➤ *Regulatory Compliance and Reporting*

The ongoing development and potential of AI solutions have started to raise the interest of regulatory bodies. Operating a compliance function within a financial services organization, banks must respond to and document why and how they develop their AI-based solutions. As the regulatory framework for AI and ML technology continues to develop, financial institutions need to adopt strong governance over both the use of these models and, if proprietary, their development.

➤ *Fraud Detection and Prevention*

Credit card transactions typically incur a fair amount of risk to both the cardholder and the service provider because they attract the possibility of fraud, thus, leading to losses. The risk consists of the risk of distress when the cardholder cannot complete the intended transaction, especially in cases where they may be traveling or in need of emergency services, and the service provider risk of incurring losses associated with the investigation over false positives in case it is determined that the transactions were legitimate. Whereas it is impossible to create a fraud detection and prevention system that is fully risk-free for both parties involved, due to the nature of predictive models, efforts have been put in place to design models that proactively classify transactions at risk of being fraudulent, and thus, mitigate the losses associated with fraud.

Machine learning is widely used in the current state of credit card services to control the incidence of fraud. Models such as logistic regression have been shown to accomplish this task well, especially when deployed along with ensemble techniques such as boosting. Logistic regression offers the benefits of balance between classification performance and interpretability, especially thanks to the availability of coefficients that correlate the covariates with the binary classification. Despite having been popular for this task, one of the key issues with logistic regression is the fact that it relies on the linear relationships between a transaction and its related covariates, and as such, works well in cases where the fraud probability is not too high. However, in the case of credit card services, historical data indicates that the underlying process that creates a transaction is not binomial, and thus, an extremely rare event

distribution, specifically the negative binomial distribution, would work instead.

➤ *Credit Scoring and Risk Assessment*

Credit scoring is a primary determiner of whether a credit card application will be authorized and whether credit limits will be approved. It is also a key determiner of the likelihood of default during the customer's credit lifecycle. Creditworthiness assessments in the front office, during origination, are critical checkpoints for assessing customer creditworthiness and preventing losses due to fraud and charge-offs. Credit scoring techniques are also heavily employed in portfolio management practices designed to mitigate losses from customers in default or at high risk of default.

Generative AI is already transforming and enhancing conventional credit scoring and credit assessment procedures in several ways, most notably through the application of Natural Language Processing technologies. First, advanced NLP algorithms may support credit scoring processes through the generation of more advanced models

incorporating novel alternative data sources. A constellation of private-sector actors has been developing models that can assess creditworthiness and reliability through machine learning. Whether applying financial data at a conventional banking institution or scraping alternative data sources on small- and medium-sized enterprises from external investor data feeds, these actors are combining both traditional data sources with less conventional data, such as social media scores or customer reviews, to develop a more comprehensive profile of credit risk.

Second, Generative AI will enhance the "call center" interaction between a customer and an AI chatbot or enhanced digital assistant. When assessing the risk of making an unsecured loan, external data analysis alone is often insufficient. A dynamic understanding of the customer's intentions and likelihood of propensity to borrow is often critical in conjunction and in comparison with external alternative data signals. Generative AI will allow for more nuanced conversations between call line assistants and customers.



Fig 4 AI Credit Scoring for Smart Lending Strategy

➤ *Regulatory Compliance and Reporting*

Generative AI can also play a role in regulatory compliance and reporting in the credit card services sector, as these firms must navigate complex and constantly changing regulatory frameworks, comply with financial reporting requirements, and manage relationships with regulators. Such efforts require large amounts of time and are often burdensome and expensive, especially without the use of AI and automation tools. By generating drafts of regulatory filings; monitoring compliance of credit card policies and procedures of internal and external stakeholders; reporting on key regulatory compliance metrics like credit card account and terminal de-risking, adherence to various regulations; creating documentation in support of audits, inquiries, and examinations related to credit card issuers' data security, anti-money laundering, terrorist financing, privacy, and other compliance programs;

and more, Generative AI streamlines regulatory compliance and reporting processes. For example, by generating drafts of regulatory filings, Generative AI expedites the completion of tasks in the time-consuming, multi-step process involved in regulatory filings, such as gathering and managing the data and information, completing the preliminary analysis, preparing the drafts, and submitting the final materials. As a further example, operationalizing AI models is not a "set it and forget it" effort and requires ongoing oversight, governance, and documentation to comply with various model risk management regulations.

Moreover, use of Generative AI's capabilities in these areas is useful because of regulators' increasing focus on firms' use of AI and associated model risk management.

## VIII. BENEFITS OF INTEGRATING GENERATIVE AI

Generative AI's potential lies in its ability to model intricate data distributions and uncover latent structures, enabling it to generate realistic samples that mirror the underlying data. However, it is essential to weigh the allure of its advanced capabilities against considerations related to economies of scale, risk management, and safety. Beginning with a careful audit of the use-case portfolio, organizations can proceed through phases of implementation, making selective investments in capabilities as maturity improves over time.

### ➤ *Enhanced Efficiency and Accuracy*

Similar to the impact of AI-powered data analytics tools — which automate data ingest, preparation, analysis, and augmentation — we believe that Generative AI is poised to bring a significant step function change in the efficiency and time-to-value of existing AI-led use cases. The dramatic reduction in development cycle time is only the start. Over time, Generative AI will extend existing capabilities, allowing more sophisticated and higher-order use cases to be implemented in impactful areas such as search, classification, and NLP. AI playbooks would become de facto configurable toolkits that allow business users to efficiently train models with minimum engineering support on curated and cataloged datasets as demand for use case implementation rises.

### ➤ *Cost Reduction and Resource Allocation*

Furthermore, with the wider availability of Generative AI capabilities, outsourcing design and development of basic applications — for instance, user-journey designs for consumer applications — to third parties could well become obsolete. The availability of pre-trained models would also result in greater standardization and lower implementation costs of existing use cases such as chatbots, translation, and classification.

### ➤ *Enhanced Efficiency and Accuracy*

Fraud schemes can be highly complicated, with fraudsters constantly innovating and finding loopholes in the existing security methods. In credit card payment systems, quite a few technology-based attack patterns have emerged, like account take-overs and application fraud, resulting in duplicated or shared credit card numbers, coordinating contrived purchases by multiple individuals over many accounts, taking over local accounts, shifting tries by manipulation of sensitive data, etc. Thus, the challenges encountered in the surveillance of credit card transactions, also known as "Suspicious Transaction Detection" and managing operational risks continue to increase as they become more complex. Credit card payments, like other payment modes, must also be equipped with tools to combat and minimize friction during the transaction. However, that

seems like a monumental task given the amount of data and the speed of transactions taking place every minute.

Generative AI tools can be employed to analyze vast troves of credit card transaction datasets to create models that are self-learning, helping speed up and improve accuracy in decision-making and veracity in data, all in real time. Accuracy is of the utmost importance, as anything less would mean the risk is ignored, which could have catastrophic consequences, while a false positive could also hamper the customer experience negatively. Rapid pattern recognition and evaluation as well as an ability to understand the myriad ways a seemingly normal customer transaction can deviate, apply behavioral clustering and bagging techniques to identify "Normal" transactions, and enable rapid resolution of Security in Credit Card Payments.

### ➤ *Cost Reduction and Resource Allocation*

Artificial Intelligence (AI) is being leveraged rapidly to automate various business services in the Credit Card Industry such as Fraud Detection, Customer Onboarding, Underwriting, Funding, Credit Limit Management, Payments, Collections, and Disputes. It is expected that much of the work will be completely free of costs or rather of the labor and expense burden that has been historically associated with most business work. Generative AI can reduce noise while increasing the relevant signal. For example, when Generative AI is being used for Personalization, Marketing Campaign Generation, Marketing Content Generation, Pricing and Promotion Strategy, etc., it reduces costs as well as the risk of failure.

Generative AI is being particularly harnessed to offload human creativity on digital content such as text and images, which are usually the most expensive part of any business cycle. It has been shown to increase speed by reducing the complexity of the generation process inherent in the work. Businesses are using Generative AI to fulfill the demand for work that exceeds the supply of highly skilled and talented people. People are being reallocated from content generation to content judgment and content reviewing. AI can present the best possible option to the human reviewer at a scale that the reviewer cannot do alone. The reviewer does the subjective evaluation of the AI present options and picks the one that resonates most as useful.

Generative AI can work at scale to meet the demand. Personalized Marketing Campaigns at Scale have generated huge demand for content. Generative AI has democratized content generation and has been able to contain costs. Meanwhile, employees are being reevaluated for their creative instincts and passions. The strongest and best minds of the content generation workforce are being reallocated to strategy and review. AI is helping companies save money and redistribute their resources where they're most effective. Companies may even choose to operate differently, establishing AI, rather than people, as the first point of contact with customers.

➤ *Improved Customer Satisfaction*

While chatbots and virtual assistants have been in existence for quite some time, they traditionally relied on deterministic script-based responses or rules dictating the kinds of conversations customers could have with them. This made those interactions both tedious and frustrating for customers, as they were limited in their scope and could provide only limited responses. They could not perform advanced actions, and if the customer question or request was complex or required some abstract thinking, the request would typically be passed on to a human agent for further handling. However, since the introduction of generative AI-based systems that rely on large language models, interactions between customers and chatbots or virtual assistants have become more natural and effortless, and these interactions can now cover just about any subject. By deploying generative AI models in customer interactions, businesses can for the first time offer truly-enriching conversations and automate resolutions to an expanded number of use cases. This, in turn, translates into improved customer satisfaction due to faster resolution times and seamless interactions. With their enhanced capabilities, generative AI systems can handle a broad range of customer requests as well as engage in two-way, iterative conversations that typically mirror human interactions. Additionally, generative AI models can be personalized and tailored to individual customers in multiple ways, significantly enriching the interactions. For instance, businesses can build customer personas based on prior interaction history and let the model refer back to them when assisting the customer. Businesses can also decide on the model's tone or persona, making him or her sound more human and relatable.

## IX. CHALLENGES AND ETHICAL CONSIDERATIONS

The implementation of generative AI in credit card services is not without challenges and ethical considerations. As these algorithms are increasingly being used around the world, the challenges will also have implications for the long-term sustainability of the use of AI. Addressing the challenges will require financial organizations to utilize solid risk and management frameworks against the AI models - these include the need for rigorous error analysis of the models, and diversified approaches to mitigate over-reliance on the AI systems because it could lead to further marginalizing of already vulnerable groups. To this end, organizations have been discussing the actual role of a trusted third party, namely the organizations, in their supervision of the algorithm outputs rather than taking a backseat while the algorithms generate insights. Banks will then be seen as a trusted third party allowing for collaborations among different players.

Data privacy and security are paramount as sensitive user and transaction data are utilized for training generative AI algorithms, and any leakage or data breaches could be detrimental to customers. Algorithmic bias and fairness are also a major challenge as AI algorithms trained on incompletely curated data can result in unfair and inequitable treatment of specific groups, leading to reputational damages for banks. Customers also want financial organizations to be accountable for the generative AI outputs used to deliver services like automated financial advice which are opaque at times and may not be completely trustworthy. These challenges cast doubt on the trustworthiness of the insights offered by the algorithms, thereby undermining the customer-firm relationship.



Fig 5 Ethical Implications of AI in Banking

### ➤ *Data Privacy and Security*

Generative AI is revolutionizing credit card services by augmenting customer experience, improving efficiency, and increasing scalability. Fintechs are increasingly relying on Generative AI to handle high-volume customer queries/requests, offer faster and personalized services, perform assistive decisions, enrich predictive analytics, optimize risk management processes, and generate reports. With growing volumes of sensitive data being shared online, data privacy and security is an important challenge that financial services firms, including banks and emerging fintechs, are faced with. While there are many regulations and guidelines around data privacy and security, safeguards addressing customer privacy issues are often undermined, or not adhered to, through unauthorized sharing of sensitive data internally and externally across the value chain. It is imperative for customer service solutions powered by Generative AI to protect sensitive information. Forward-looking banking organizations are tying Generative AI systems in the customer experience domain with their existing enterprise privacy and cybersecurity practices and solutions.

Larger banks have safeguarded their existing enterprise customer privacy practices while training and fine-tuning Generative AI systems with sensitive customer data. These rules ensure that customer data remains protected while leveraging GenAI and other AI use cases. With increased knowledge transfer, existing banking guidelines covering security, supervision, personnel, data handling, governance, environment, and technology can be applied to entities focused only on the Generative AI space. Additionally, partnerships between fintechs and larger firms can restrict or limit data transfer verticals, and be strengthened with privacy-related governance controls such as privacy impact and risk assessments. By placing the right organizational guardrails, financial institutions can further sharpen consumer trust while benefiting from the efficiencies derived from implementing Generative AI systems.

### ➤ *Algorithmic Bias and Fairness*

While generative AI has the potential to transform customer experience through personalization, the use of such sophisticated systems to enhance service operations brings with it a set of ethical concerns. Increasingly, customers expect personalization with fairness and at scale, which is a significant challenge. Various studies have reported evidence of bias in AI systems regardless of whether the bias is in the objective function values or the predictions or the embeddings estimated by the systems. Discrimination can occur if input variables are considered to be proxies for sensitive or protected attributes like race, gender, age, disability, sexual orientation, or religion. Some supervised models are also susceptible to what is known as “label bias” or bias based on the labeled data used for model learning and training. Care must be given to address any such biases in a predicted customer category when implementing these models in the business. Moreover, algorithms have been

known to produce outputs that differ from human expectations or significant subgroups in a population. So, the AI decision on personalization must not be completely automated but be overseen by human decision-makers. In fairness-aware modeling, the role of model interpretation skills of data scientists becomes particularly important.

While there are methods available to correct for biases both before algorithm development and also post-hoc corrections, such fairness-enhancing strategies must be incorporated at the design stage and pre-validation or pre-deployment stage for improving fairness. These correction methods work best when the original model is a simple one rather than a complex neural network model. Key considerations in determining bias include establishing the purity of the attribute being predicted, the criteria for group membership, the evaluation metrics to be used, and issues of adversarial fairness, depending on the specific business application itself.

### ➤ *Transparency and Accountability*

Increasing transparency to promote better decision-making processes in credit services rests on a fundamental tension in that it can increase customers’ understanding and trust, but also expose these services to consumers by making it easier for them to overwhelmingly distrust their lenders. In other words, there is a fine balance between revealing too much information in explaining how and why a credit decision was made, and to whom that decision is exposed.

Transparency is a difficult standard to meet in a machine learning context, as revealing the information requested risks giving malefactors dangerous leverage over the algorithms used. Research has explored numerous different strategies to explain algorithms ruling credit access decisions. Another aspect of these algorithms further complicates the transparency goal. The information is not just potentially but subverted by algorithmic adversaries. Those parties use a platform to learn how to parent a model, or reverse engineer it through repeated testing and machine learning. Courts and regulators need additional insight into how algorithmic adversaries subvert services’ models, what vulnerability metrics can help maintain the integrity of the predictions, and how algorithms can be prescribed to limit the potential damage.

When it comes to networks deciding how to optimize transaction flows, there is less concern about algorithmic adversaries. Nevertheless, these systems need to maintain accountable trust with their transaction process network participants. Once more, networks deciding who is high and low risk in accepting or rejecting transactions will face the same opacity concerns as with other decisions once they venture into machine learning methods. Conceivably, retaining optimal accountability through transparency could be achieved without foregoing the efficiency gains of machine learning, but it could prove more of a challenge.

## X. FUTURE TRENDS IN GENERATIVE AI AND CREDIT CARD SERVICES

The Global Artificial Intelligence in BFSI Market is expected to generate revenue of approximately USD 58 billion by 2027, and technological advancements in the market are the key drivers of growth. Hence, any developments based on innovations in related technologies will impact how successful Generative AI will be specific to Credit Card Services. One such technology is Quantum Computing, and with advancements in this field, Generative AI may take customer experience to make or break decisions. Generative AI may overcome resource limitations and support simulation-based tasks more realistically. Businesses can leverage Generative AI applications that offer simulations along with accurate risk estimations, minimizing this, despite high pricing.

With advancements in Generative AI technology, gradual movement from transactional utility functions to Digital Human Utility functions is a given. The more of these capabilities that are incorporated in the mode of interaction with products and services, the more impactful the consumer overall experience is likely to be. We see such future products for customer service wherein customers are transferred to Digital Humans, or Brands generating Digital Humans as explainers for innovative products at the validation stage of commercialization. Generative AI gives companies the ability to do personalized mass marketing on a level that has never been possible. Businesses can deploy these AI tools to deeply personalize marketing flows and maximize efficiency. Further Insights about additional aspects of personalization are shared in Chapter 5.

### ➤ *Emerging Technologies and Innovations*

The world is changing rapidly, driven by new technologies and innovations that alter how we live and work. Emerging technologies, such as generative artificial intelligence, will continue to rapidly transform consumer behavior and spur the creation of new product and service innovations, changing a bank's strategy, business models, and engagement with customers and partners. Examples of capabilities driven by technologies such as generative artificial intelligence include: digital workers who can speak or text to customers in their language; digital workers limited only by the company's creativity who can handle any interactions with customers via voice, chatbot, or web interface; intelligent apps selected by each user based on their needs; personalized learning and training bots alongside us in our work and personal trainings; immersive learning and training environments that feel completely real; deep underscores, images, sounds, movies, or games induced by conversation; and all these services significantly cheaper and easily customized for each customer. Banking industry leaders should begin now to integrate these capabilities into their organizations to compete in a world of services that are extremely affordable and customizable.

These innovations will not only change the customer experience but will also introduce new ways to detect, analyze, and audit risk in credit cards. As new products and services are developed using these new technologies, it is important to assess how credit card risk will be affected and how risk management in payment services may need to adapt. Adding these new methods as overlays to existing rules-based systems, instead of entirely replacing the existing systems, may be appropriate for certain new types of systems. Aspects of risk may also be different for innovative products with limited offerings. Exploring and experimenting with the new technologies will also allow for a faster understanding of how credit card services will be integrated in the future.

### ➤ *Predictions for Customer Experience*

The banking and credit card services industries are being reshaped by technological developments. A recent study found that 87% of banks and credit unions plan investments in AI over the next two years. A survey found that 41% of banks were investing heavily in user experience design, the highest of the sectors considered, prompted by heightened consumer demand for convenient and easy-to-use digital banking tools and services in addition to the pandemic shift to digital. This increased attention to user interface and experience design, along with rising credit card activity, competition for customer loyalty, and investments in open banking solutions, such as traditional banks' partnerships with fintech companies, will pressure banks to modernize their payment systems. A report stated, "The payments infrastructure of banks and card companies is going to experience significant upheaval over the next few years. Recent investments in digital infrastructure to support rapid business model changes are only the beginning. As complexity rises, banks and card companies will need to leverage their strengths as part of a broader ecosystem if they hope to avoid being relegated to commodity players or squeezed out of the market altogether."

Generative AI can help financial institutions by delivering customized products and services, such as virtual assistants for beyond-banking interactions; automating manual customer service tasks, such as customer data collection; personalizing risk assessments; reducing onboarding friction; enhancing card control features; improving crisis communications; and building seamless payment integrations. A critical area where banks are investing in modern technology with customer experience in mind is in the onboarding process. Because of the time and work involved, as well as the amount of sensitive data being handled initial onboarding can create friction and is a prime candidate for applying AI.

### ➤ *Evolving Risk Management Strategies*

Risk management can be explained as a process to identify potential risks, evaluate their impact, and deploy strategies to minimize or eliminate the risk. Risk management in credit card services is a complex exercise

that involves monitoring customer transactions in real-time, while scrutinizing a plethora of transaction-level variables that can signal unusual activity. The current risk management processes are heavily reliant on rule-based systems and conventional machine learning models that usually deploy black-box deep learning systems to detect anomalies.

Such setups come with limitations. For one, they can be cumbersome as they need to be re-trained at regular intervals, primarily because the data on which they are trained may no longer reflect current spending patterns and therefore such models may no longer be as effective. Moreover, rule-based approaches can also generate too many false positives, creating friction in the customer experience and adding to the costs of back-end operations. With rising inflation, high interest rates, and uncertain job markets all adding to the economic woes of consumers, there is a greater risk of credit and fraud losses that can impact financial institutions.

AI, especially generative AI, appears to come to the rescue. Imagine LLMs that can not only be fine-tuned with specific datasets but also incorporate external datasets to better evaluate the risks for individuals based on their past behavior. All these can reduce the need for retraining the models, at least not as often as conventional models. Combining this with the rapid deployment of intelligent conversational agents in customer service can streamline processes and reduce operational costs and inefficiencies while eliminating the risk of manual errors.

➤ Equation 3 Risk Score for Transaction Monitoring

$$R_t = \sum_{j=1}^m w_j \cdot |x_j^{\text{real}} - x_j^{\text{gen}}|$$

Where

$R_t$ : Risk Score for a Credit Card Transaction

$x_j^{\text{real}}$ : Actual Feature Value (e.g., transaction amount)

$x_j^{\text{gen}}$ : Expected/Generated Feature from AI Model

$w_j$ : Weight Assigned to Each Feature  $j$

$m$ : Total Number of Features Considered

## XI. CONCLUSION

In summary, Generative Artificial Intelligence (GenAI) systems are increasingly relied upon within customer experience (CX) functions and risk management in credit card services. While there is considerable commentary on the use of GenAI models, it is important to recognize that the GenAI landscape incorporates a wide spectrum of both foundational models and other available tools and applications. These capabilities are applied across a diverse spectrum of use cases, ranging from shaping product and service experiences to driving innovation, improving operational efficiency, and mitigating emerging risks, such as those stemming from restricted data access to the risks of bias or inaccuracy embedded in generative AI outputs. The application of GenAI is very much a work in progress – still at the experimentation stage in many cases. As such, balancing the opportunities presented by Generative AI-enhanced CX with the transitory risk environment is equally important.

Given these observations, we provide some key recommendations for a balanced application of GenAI in the role of CX enhancers and risk mitigators. Organizations must proactively embark on the education of stakeholders at multiple levels for the productive usage of GenAI tools in a thoughtful way. Thoughtful procedures will ensure that it is not just engineers or a small set of data scientists that can use GenAI tools, but that every stakeholder is aware of the capabilities of these tools and acts accordingly. Additionally, organizations should consider implementing and continuously updating guidelines that help users in the decision-making process when they generate AI-driven results. Moreover, companies should remain innovative in tech sectors, while also keeping a critical stance toward upcoming trends and changing landscapes.

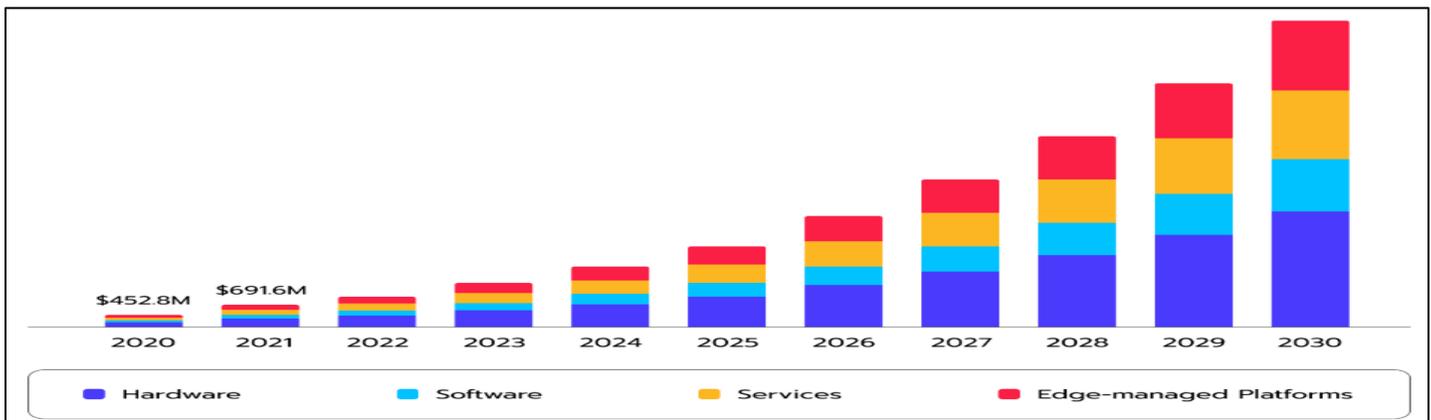


Fig 6 Transforming Credit Risk Management

➤ *Final Thoughts and Strategic Recommendations*

Generative AI in the credit card domain is a new phenomenon in its early heyday. Embedding foundation models into real-world business processes is a massively complex undertaking involving highly iterative cycles of process design, application modeling, software engineering, and quantitative evaluation over time. It typically involves creating new derivative model architectures for specific business process use cases, such as customer qualification, next-best offer recommendation, auto underwriting, fraud detection, and transaction leasing, alongside their deployment within vertical business process applications and software modules. The combination of vertical applications, data engineering for vertical domains, and actual business usage cycles for specific generative AI projects in the financial services sector are thus ideal areas for establishing a competitive market advantage through research, prototyping, and iterative deployment.

To support the exploration of generative AI technologies into the core domain of credit card services outlined in this report, we recommend a two-pronged strategy. In the short term, we recommend the exploration of general capabilities of generative AI technologies built on large foundation models through the original model APIs offered by foundational model companies. This includes understanding the limitations and challenges of using generative AI with proprietary quote credit data and developing mitigation strategies. In the longer term, we recommend the establishment of an internal effort to explore the domain-specific use of alternative proprietary and open-source solutions for instructional learning into the full suite of credit card services with access to proprietary internal and external business process data. By establishing a dual-pronged strategy, valuable insights into generative AI technology can be gained and its use operationalized at scale across the many services designed for credit card services.

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