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Human-centred artificial intelligence in the banking sector

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Human-centred artificial intelligence in the banking sector

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Abstract Changes in technology have shaped how corporate and retail businesses have evolved, alongside the customers' preferences. The advent of smart digital devices and social media has shaped how consumers interact and transact with their financial institutions over the past two decades. With the rapid evolution of new technologies and customers' growing preference for digital engagement with financial institutions, organisations need to adopt and align with emerging technologies that support speed, accuracy, efficiency and security in a user-friendly manner. Today, consumers want hyper-personalised interactions that are more frequent and proactive. Moreover, financial institutions have a growing need to cater to consumers' new demands. Financial institutions, such as banks, continuously adapt to the latest technologies to keep pace with evolving customer behaviours, needs and experiences. One such emerging technology is artificial intelligence (AI). Many organisations realise the potential of AI. A human-centred AI system, however, must be capable of understanding human characteristics and making decisions like humans. This paper aims to help banks understand the importance of deriving and processing customer emotions from the unstructured data captured from

various omnichannels to develop full-fledged human-centred AI-enabled products and services, with emphasis on practising a co-development mindset between the important stakeholders (banks, IT vendors and focus groups). In addition, the paper proposes a framework for banks to adopt and stay competent on the digital transformation journey.

KEYWORDS: artificial intelligence, ethics, bias, transparency, customer experience, banking

INTRODUCTION

Gone are the days when products and services were designed from a purely business organisation or technology-centric point of view. Today the business world has realised the importance of customer experience, and businesses now develop products and services from a customer-centric perspective. In the current banking business scenario, traditional banks face challenges primarily owing to the entry of non-bank FinTech companies that are offering equivalent direct substitute financial products and services, thereby capturing market share away from traditional banks. These FinTech business strategies have put banks under tremendous pressure. In response to this competitive landscape, and as a means of improving customer experience, most banks have significantly increased their delivery of banking services digitally. For banks to provide best-in-class digital experiences, they must apply AI technology with an increased emphasis on human-centredness, incorporating a more intimate and intuitive understanding of their customers. Banks must proactively and quickly capitalise on the power of AI to competitively advance in their digital transformation journey. The primary objective of this paper is to benefit banks in three areas: first, to explain the AI principles around ethics, bias and transparency, as well as the intended and unintended consequences, which are important considerations for implementing AI-enabled banking products; second, to help banks better understand the

importance of practicing a co-development mindset by working closely with their IT vendors and customer focus groups; and, third, to propose a framework to help banks set a clear direction for designing and creating human-centred-AI (HCAI)-enabled products and services for a better customer experience.

HUMAN-CENTRED ARTIFICIAL INTELLIGENCE

HCAI is the continuous machine learning (ML) process that AI algorithms use to understand humans and their responses to specific situations or stimuli. The AI system automatically updates as it learns from humans and thus becomes a more ‘intelligent system’ that interacts with and assists humans in ways that are easier and more effective for humans to use. Such a learning mechanism reduces the gaps between humans and machines substantially.¹ AI scientists and experts realise the importance of human-imitative AI. Stanford University, the University of California, Berkeley, and the Massachusetts Institute of Technology have established HCAI research institutes that emphasise that AI should combine technology and human elements in the near future without replacing humans.² An important research direction in AI is to develop objective control and autonomy measures tied to diverse tasks to stimulate more meaningful design discussions that will lead to improved guidelines, evaluations and more valuable outcomes.

Today, the algorithms that control AI and ML do not meet industry needs completely, especially in making critical autonomous decisions. In addition, the latest digital transformation has not reached a level that results in complete trustworthiness and customer satisfaction compared with performing the same operations through human-to-human interactions. These are the gaps in the existing AI systems to be addressed. To overcome these challenges more effectively, the existing algorithms must be redesigned by including the capabilities they need to build useful interactive systems with human elements to interact with different stakeholders. The primary advantage of shifting towards HCAI is that it helps the AI system to interact with humans in ways that understand their needs and emotional elements so that the AI system can respond with a human touch. Concurrently, the AI system continues to learn from every human who interacts with it.

AI-enabled product design and development must also abide by the following AI principles, as illustrated in Figure 1, in order to be able to achieve better control and trust over their outcome.

AI PRINCIPLES

Ethics

Researchers have focused increasingly on integrating ethical validations into AI-enabled systems in recent years, leading to several initiatives. In this sense, incorporating ethical values into product design will be an important challenge for AI developers.³ Even banks serving customers in-person cannot guarantee that they handle them ethically every time. Therefore, protecting customers should be a higher priority than promoting something good.⁴

Bias

Data bias

Data bias is using a specific data set with the intent to verify an anticipated result. Finding the problem’s depth is a complicated process.⁵ Incorrect training data is the root cause of an unfair bias. Some types of biases from different sets of data roots and collections are observer, historical, representation, measurement, evaluation, aggregation, population,

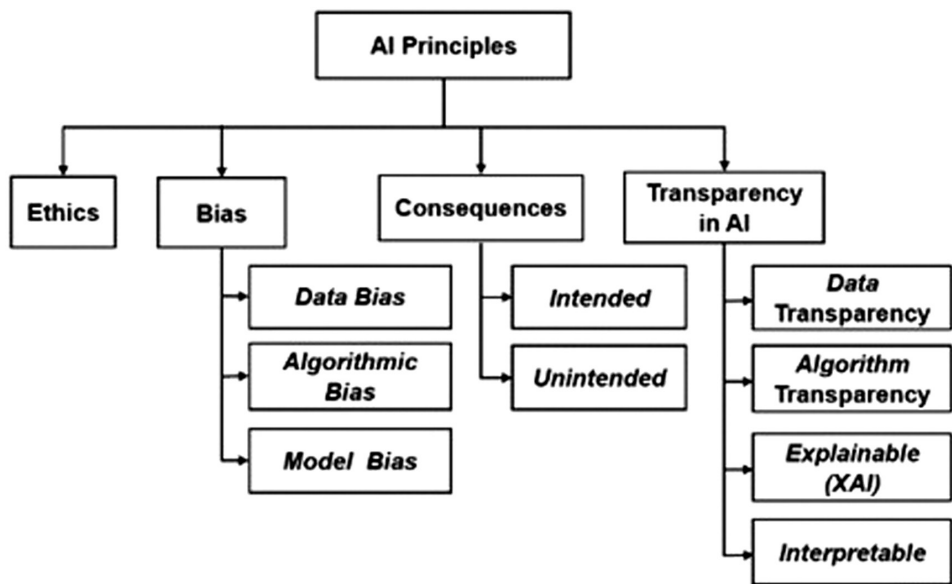


Figure 1 AI principles

sampling, behaviour, social, self-selection and cause-effect.⁶

Algorithmic bias

It is always a challenge to design and implement a fair algorithm, and reducing algorithmic bias is one of the important puzzles we face in ML today. As a result of years of research, ML frameworks and tools such as 'BeFair' are gradually being developed to reduce bias in banking.⁷

Model bias

No model is perfect; the closer the model is to the expected performance, the better the model is. A model bias can be described as the model's low variance that does not have a close match with the training data set. Bias can happen in different forms, even at the data level, and this may mislead the way the ML models make decisions, thus affecting the model's future data. The model's accuracy is determined by the quality of the data and the algorithm design. ML model bias can be categorised into model bias, model variance and outcome noise.⁸ AI and ML models are mathematical algorithms used to predict an outcome after being trained using specific data sets as input to make decisions autonomously like human experts. The challenging part in designing ML models is disclosing and justifying the reason behind the autonomous decisions made by the models.

Consequences

Intended consequences

As the usage of AI increases, the criticality of AI agents' behaviours also increases. The integration of AI agents is becoming unavoidable in our day-to-day decision-making activities in important domain areas such as medical, engineering, securities trading, defence and finance. One of the primary objectives in the banking sector is to reduce the number of branches

and the size of existing branches. For example, in the Netherlands, over 50 per cent of branches closed in the past few years.⁹

Some of the intended positive consequences of adopting AI systems include the following: (i) Redundant cognitive activities, for example, banks' internal operating activities like knowing their customers, protecting against money laundering and data entry operations, can be converted to fully automated processes. (ii) Lowering the amount of time needed to perform redundant operational activities that can be done largely without human dependence, thus eliminating human errors and improving performance and quality. (iii) Allowing human resources to be effectively utilised for new initiatives by training them on AI technologies and AI culture. (iv) Significant reductions in operational costs and increased productivity.

Unintended consequences

Unintended consequences refer to those that do not occur by a purposeful intent. Unanticipated consequences are those with unforeseen outcomes that occur unexpectedly. AI technologies will certainly benefit humankind while leading to potential challenges and new risks. In other words, unintended consequences are similar to accidents that occur owing to errors. For example, banks that deliver services only virtually (ie exclusively via online channels) depend more on their AI systems. The end-to-end transactions occur only online as there are no face-to-face interactions. In such banking models, there are very high chances of the AI-based system rejecting valid loan applications owing to rigid, systematised parameters. Such an outcome may lead to unintended negative consequences to the bank, such as financial losses and damage to the bank's credibility and trustworthiness of the banks' technology. Therefore, it is important to ensure that the consequences are determined ethically and predicted beforehand.

Transparency in AI

Data transparency

Data is the fuel needed for any AI-enabled system to function. The AI systems outcome is determined purely by the data processed by the models, algorithms and ML functions. An algorithm can behave in different ways depending on the type of data used to train the model. For example, the Massachusetts Institute of Technology and Stanford University jointly analysed a few facial recognition systems. Their research showed that each system's accuracy was different owing to its gender and race parameters.¹⁰

Some banks are exploring the possibilities of maximising the benefits of merging their customer data and Big Data with AI capabilities in different ways. These include (i) understanding the banks' current customer base's needs and behaviours, (ii) merging customer data with the relevant data accessible via reliable social media sources to gain better insight into customer behaviours, (iii) hyper-personalising the banks' products and services based on the customer's past spending patterns for a better product recommendation. Moreover, global banks have released complementary financial tools by exchanging financial data with third-party FinTech firms and exposing application programming interfaces (APIs) to developer communities.¹¹ This approach helps to get more data from reliable sources for better data transparency, understand customer behaviour, improve the application's performance and understand customers' mindsets to serve them better with more effective AI-enabled products and services.

Algorithm transparency

Data and algorithms are tightly coupled together. Higher data volumes help to effectively utilise an algorithm's capability and help derive better business insights. Transparency in an algorithm determines the accountability and usefulness of an algorithm. Without transparency, it would not be easy to

trace the root cause of a bias and understand the rationale behind an AI system's decisions.¹² Researchers are greatly concerned with the need for transparency in algorithms. Currently, the opacity is high in the algorithms used in autonomous decision-making systems.¹³ Thus, to extract the algorithm's potential to the fullest, studies recommend that the algorithm developers keep in mind that the outcome of an algorithm must be observable and explainable. Secondly, human operators must manage the input and output, train the data set, customise and provide feedback based on the outcome. Some researchers are trying to achieve 'fairness, accountability and transparency (FAT)' in the outcomes generated by algorithms.¹⁴

Explainable models (XAI)

Explain-ability is a mechanism that helps to authenticate AI's predictions, enhance models, give better insight into problems and identify the defects in models and databases. The first property of algorithms that allows explain-ability is transparency. The primary objective of an XAI system is to provide detailed explanations. The term explain-ability should include competencies, identifications, completed activities, current activities and the processing of information.¹⁵ Explain-ability, however, is domain-specific. Observations have shown that the performance of models vary based on the features they used to make decisions. Hence, with the help of explanations, it would be easy to identify a suitable model and the rationale behind its successes and failures, thus leading to an improved model.¹⁶ Thus, XAI has become vital to gain more trustworthiness.

Interpretable models

Interpretability can be defined as the extent to which a human can know the rationale behind the decisions taken by a machine. With the surges in the critical decision-making and predictive activities

of black-box ML models, AI stakeholders are more concerned with and show more commitment to the model's transparency.¹⁷ Most ML models are not designed to include a set of interpretability checks; instead, the model's primary focus is on the accuracy of the outcome based on a given data set.¹⁸ A model is considered interpretable only if it can explain every component as a working mechanism, transparency in the model's underlying algorithms and simulation. The model's size and variables play a significant role in maintaining the decomposability and simulatability of the model.

UNDERSTANDING HUMAN EMOTIONS AND THINKING

Human emotions and thinking

A bank's primary digital objectives can be achieved only when business and technology understand the customers' needs and behaviours, including their emotions, and provides a satisfactory user experience with a human touch. Understanding and predicting human behaviour is a complicated process. In psychology, focusing more on prediction than on explanation gives a superior understanding of behaviour.¹⁹ Training data sets do not adequately capture all human behaviours and emotions. For instance, in 2017, an IndiGo airline passenger flying to Calcutta had his check-in luggage sent to Hyderabad by mistake. The passenger sent a sarcastic e-mail about his experience, 'thanking' the airline for its brilliant service,²⁰ but the AI-enabled system read the e-mail content and sent an automated reply to the customer stating, 'Glad to hear that!'. It is evident that the AI system failed to correctly comprehend the customer's information, intention and emotions as expressed in the message, and this failing will negatively affect customers' experiences. In the current global economy, any product or service's success and longevity are determined by their global acceptance.²¹ Therefore, machines must be trained for accurate pattern identification

based on their fed data to make autonomous decisions ethically. The AI system must integrate the essential underlying knowledge of ethics.

Integrating domain-specific knowledge with transparency in data, algorithms and models will lead to an opportunity to design and develop complete trusted decision-making AI systems. Such AI-enabled systems would help banks maintain their relationships with customers, maintain their credibility and increase customer loyalty.²² Through the use of the power of neural networks, new models could be developed for end-to-end digital banking services with cognition.²³ Effective utilisation of 'model-free reinforcement' pedagogy in a Deep Q-Network enables faster selection of responses. Understanding customers' minds is also essential, and this is aided by capturing customers' emotions and behaviour. Research shows that the human brain functions similarly to the 'model-free reinforcement' learning mechanism, which helps to construct the cognitive mapping of the situation and strategise the series of steps to handle complex tasks.²⁴ Adapting to this rich learning mechanism opens a new path to explain how the world has understood human minds.

To develop AI-enabled products and services that provide high-quality and accurate contextual services with a human approach, now is the time to integrate the capture and processing of customers' emotions and thinking into ML models.

Theory of mind and Big Data

Valuing human touch is mandatory to develop a positive impact on customer relationship.²⁵ To design a full-fledged HCAI system that can interact with humans and understand their needs, the system must be built with the 'Theory of Mind',²⁶ which is an essential intellectual ability that broadly covers our potential to read others' thought patterns such as feelings, passions and knowledge. In simple terms, the 'Theory of

Mind' can link various mental states of an individual that continuously improve and perform over a period. Numerous researchers recommend that banks focus more on empathy and assurance.²⁷

Combining Big Data analytics and AI leads to novel value propositions,²⁸ and integrating HCAI capabilities will enrich customers' experiences. Therefore, now is the time for banks to take proactive measures to understand customer needs by embracing HCAI design with AI capabilities. This can be achieved by collaborating with the right IT vendors, to stay competitive and to retain and expand their customer bases in the rapidly growing financial services market.

RATIONALES FOR BANK-FINTECH-CUSTOMER FOCUS GROUP PARTNERSHIPS

Apart from the traditional banking branch model, banks started offering their customers a wide range of options to perform their banking needs through various digital platforms such as social media, internet banking, mobile banking, wearable banking, etc.²⁹ However, banks have started to realise the need and urgency for integrating human capabilities into AI systems. It is now time for banks to take proactive measures to identify customer needs by embracing human-centred design with AI capabilities,³⁰ by collaborating with IT vendors with the right AI technology capabilities and skilled resources to stay competent and retain and expand their customer base in the rapidly growing market. Therefore, whether building internally or partnering with an IT vendor, it is recommended that banks adopt a robust framework to design and develop HCAI-enabled experiences.

Responding to customers' perspectives

Owing to the increasing digitalisation and integration of social media platforms, many self-service technologies are available to

customers for the same types of transactions and activities. For example, customers now have more choices with regard to making payment transactions within the region and cross border (via WeChat, Facebook, Google pay, etc). Even so, customers want to begin their transactions with shorter waiting times and with human interaction. Recent research conducted by Nainital Bank in India shows that even though the branch has many teller counters and ATM counters, 25 per cent of customers still need to wait more than 15 minutes for their turn.³¹ Other research shows that in the US region alone, over 50 per cent of telephone banking consumers wait up to 15 minutes and that 25 per cent of customers disconnect their calls within the first five minutes of waiting.³² It is a bank's responsibility to serve customers within a reasonable waiting time. This is one of the important reasons for rapidly changing customer preferences and switching behaviours. Such changes in customer behaviours have made it challenging for banks to predict their customers' preferences.

Working effectively with IT partners

As banks are not technology solution providers, most IT-related functions such as software development, infrastructure services and technology staff hiring are outsourced to multiple IT vendors.³³ The outsourcing model has been in practice for decades, as it reduces banks' risks of owning IT resources and infrastructure. In the rapidly changing corporate world, if there is no close coordination between banks and their IT vendors in terms of project execution methodology, collaboration strategies, practices and business alignment, the chances of project failure are high. Most organisations, including global banks, believe that transforming into digital services and integrating AI capabilities will increase their revenue and net income. They are, however, unsure about how and where to effectively utilise the power of AI.

Another important aspect of banking success is strategic alliances. A strategic partnership is an engagement between organisations that includes the co-development of services, products and technologies. It is not only a bank's but also the IT vendor's responsibility to meet the customer's demands and provide better customer experiences since they help develop banking products to meet the banking customers' needs. Product proprietors must adopt a co-development strategy to develop positive impressions and trust.³⁴ The main dimensions of collaboration related to successful strategic alliances are integrating thoughts and information from various sources, aiding and addressing problems proactively.³⁵ Close collaboration opens up new avenues for solving complex problems. Hence, to improve the effectiveness, positive impact and value of HCAI products and services with a human touch and to increase customers' trust, banks

must closely interact with customer focus groups and IT vendors who provide software, platform and infrastructure services.

Involving the focus group team from the AI product design stage until the product testing stage will help obtain inputs, suggestions and feedback at every development stage from end-users' perspectives, which in turn help to reflect, refine and enhance product quality. Figure 2 shows how important stakeholders collaborate by sharing core capabilities and selectively revealing core competencies with a co-development mindset, to increase the effectiveness of HCAI products and services.

Therefore, to achieve such human-independent facilities, both banks and their technology partners must believe that knowledge spillover will mutually benefit in different structural forms by 'selectively revealing' their core competencies and that this, in turn, will foster an innovative culture.³⁶ Hence, to convert threats into

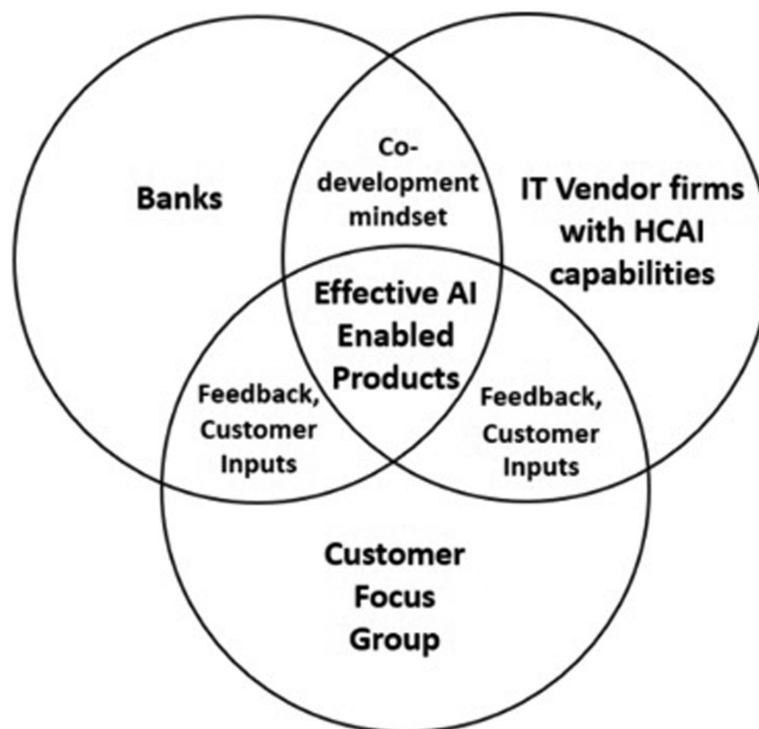


Figure 2 Co-development mindset for effective HCAI-enabled products

new opportunities, banks should collaborate with FinTech firms, core banking software development firms and focus group firms with a co-development mindset.³⁷

ROBUST FRAMEWORK TO DEVELOP HCAI-ENABLED PRODUCTS AND SERVICES

As discussed previously, the important components (human emotions, human minds, co-development mindset and AI-transparency) are organised into the pyramid shown in Figure 3. The pyramid illustrates how unstructured data can be turned into better HCAI products and processes by satisfying the AI principles for better customer experiences.

The pyramid transforms into a robust framework that is easily adopted, implemented and practised. Banks are strongly recommended to adopt the proposed framework as shown in Figure 4.

The proposed framework is built using five building blocks, each in turn made up of basic components. The framework blocks are built on top of the infrastructure and the governance layer, as shown in Figure 5

to help build future-ready engineering capabilities to effectively handle high volumes of unstructured data and improve efficiency.

Establishing a dedicated AI infrastructure produces the following important benefits: First, AI-skilled resources, learning and knowledge gained in developing AI-related projects and other related initiatives can be retained and managed under one roof. Second, apart from the development activities, the platform can be turned into a complete knowledge base system and learning hub over a period, whereby new resources can be educated and trained, thereby significantly reducing the risk of running short of AI talent. Therefore, establishing a dedicated AI infrastructure wrapped with robust AI governance will serve as the foundation of the proposed framework.

The first block shown in Figure 6 covers the processing of human capabilities. This block comprises two constructs: human emotions and human minds, which allude to human capacities. The primary goal of this block is to extract more precise and meaningful data points and insights about

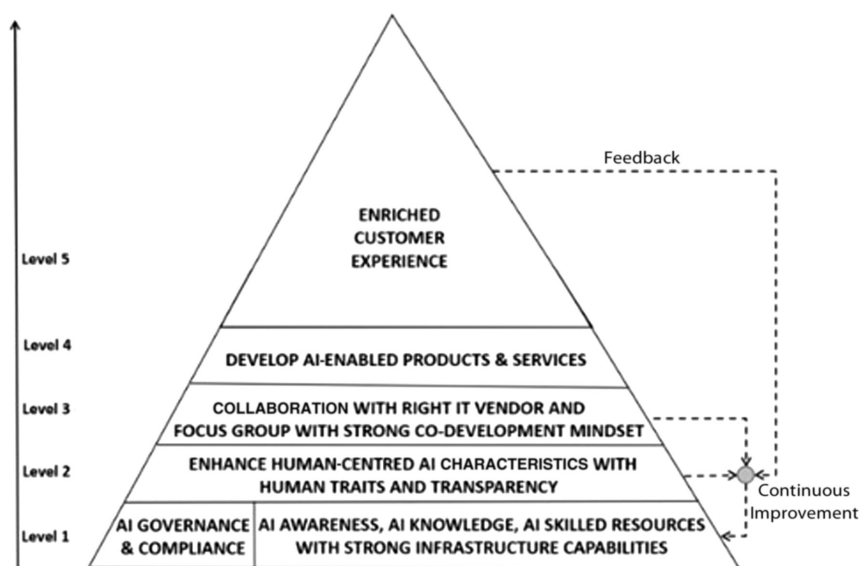


Figure 3 Pyramid bottom-up model for a better customer experience

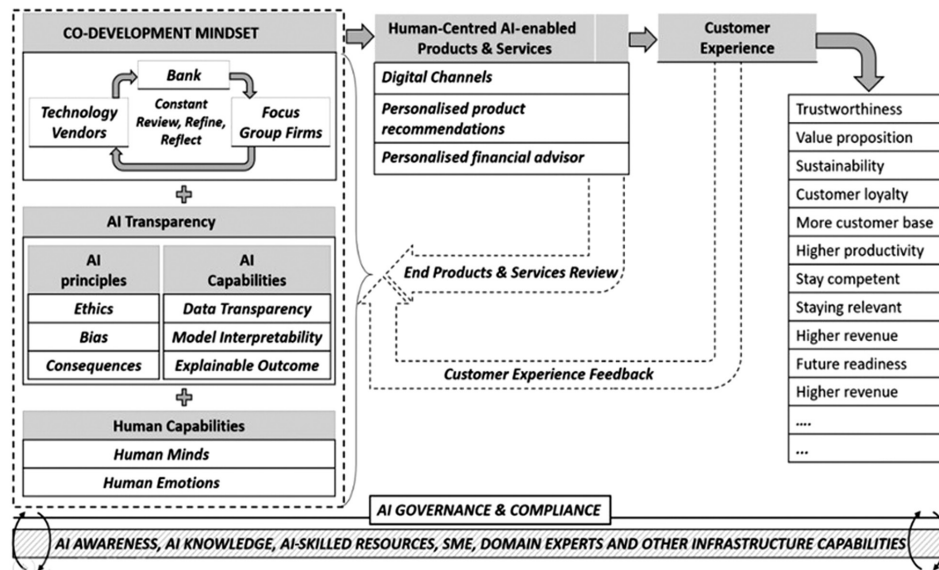


Figure 4 Framework for banks to strengthen the HCAI

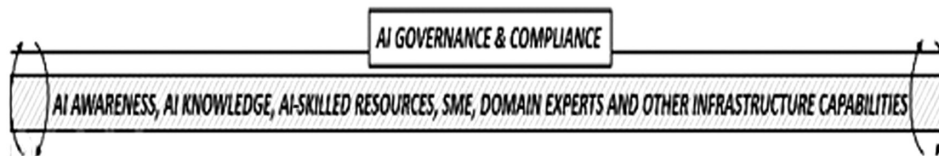


Figure 5 Infrastructure and governance layer

Human Capabilities
Human Emotions
Understanding Human Minds

Figure 6 Human capabilities

human traits from unstructured data with the collaboration of subject matter experts and AI specialists. This data can be used as additional inputs to optimise the ML models training to boost the effectiveness of AI-enabled product development.

The second block covers the complete AI operational part comprising subcomponents AI capabilities and AI principles, consisting of important elements of the framework component, as shown in Figure 7. In this block domain experts and AI technology experts focus only on addressing the gaps

AI Transparency	
AI Principles	AI Capabilities
Ethics	Data Transparency
Bias	Model Interpretability
Consequences	Explainable Outcome

Figure 7 Transparency in AI operations

with respect to data transparency, model interpretability, model explain-ability, model predictions and ensuring that automated decisions made are ethical, unbiased and accountable, by considering all its related consequences. Minimising the aforementioned gaps will help crack the AI black box, making the AI operation more transparent and exposing the inner working mechanism.

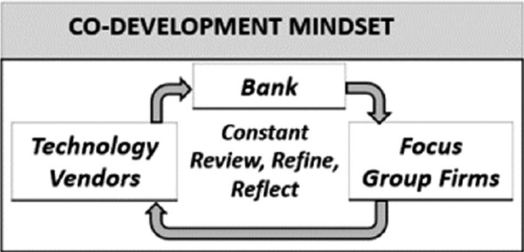


Figure 8 Co-development mindset

The third block consists of the important stakeholders (banks, IT partners/vendors, focus group teams). In the process of developing new products using niche technologies, it is recommended to have a long-term collaboration strategy and engagement model between the FinTech firms, banks and focus groups. Such an arrangement will help banks gain confidence in working closely with a co-development mindset and trust between the important stakeholders. Furthermore, it will help break down mental blocks and barriers to understanding and sharing their business needs, which in turn will lead to their IT vendors and focus groups sharing and collaborating to meet the common objectives, as shown in Figure 8. Cultivating a co-development mindset and a working culture among important stakeholders will have a positive impact on the effectiveness of AI-enabled product development.

All three blocks of the framework act as an engine for incorporating human capabilities, AI operations and a co-development mindset, and this will help design and develop innovative AI-enabled products and services with increased human touch. Such products can be exposed to various omnichannels, shown in Figure 9, for personalised product recommendations to serve customers in a hyper-personalised way, resulting in a much improved and more responsive customer experience.

The improved customer experience obtained through HCAI products will help to gain more trust over the products and enhance the credibility of the service

provider. Therefore, by adopting the proposed framework, banks can eventually get more opportunities in terms of revenue, customer base, value proposition and market competitiveness.

DISCUSSION

A study was conducted based on the survey data collected from the participants from banking software firms, FinTech firms (specialised in providing AI-enabled banking solutions) and the focus group firms.³⁸ The study identifies the following barriers faced by banks in competing against incumbents and new entrants in the banking business.

Lack of AI technology skills

Most of the banking software and FinTech firms were assessed comparatively highly in their understanding of the importance of integrating AI technologies and with the evolving advancements in the field of ML and deep learning. Furthermore, the survey participants realised the significance of capturing and processing information pertaining to human capabilities such as human emotions and understanding human minds from unstructured data gathered from various omnichannels and of training the models to develop effective HCAI-enabled products for the banking industry. In addition, the majority of the participating tech firms lacked end-to-end

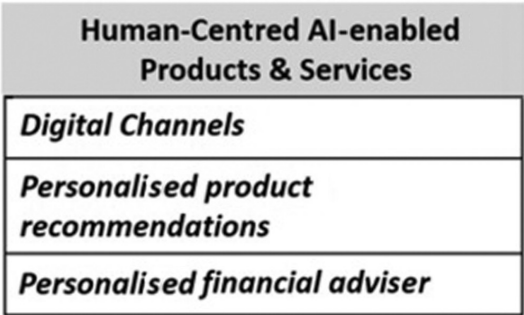


Figure 9 HCAI-enabled products and services

AI technology competency, infrastructure, AI-skilled resources with business domain knowledge and other domain expertise (eg linguistics and psychiatry) to fully explore and exploit the possibilities from various dimensions. Although some of the tech firms involved in the research survey had good AI capabilities, they were lagging in certain important areas such as validating the source of the data. In addition, the algorithms generated by the ML models used in these firms did not satisfy the criteria of explain-ability, interpretability, accountability and consequences. In other words, the overall AI operations were not completely transparent and were therefore perceived as a black box.

Banks must focus on gaining awareness and knowledge and recognise the importance of adapting to AI technologies and upskilling their IT resources in the AI space. Thus, the bandwidth of a bank's IT division and its IT vendors will strengthen and help to mutually leverage the competitive advantage in developing HCAI-enabled products and services.

Lack of access to banking unstructured data

Banking software firms and FinTech firms' AI technology maturity levels are increasing over time. The power of AI capabilities, however, cannot be fully leveraged until the correct business data is processed. Most of the banking clients of banking software and FinTechs are reluctant to share their unstructured data collected from various banking channels with their IT vendors. This could be due to the banks' regulatory policies, data privacy, compliance and governance policies. In addition, banks have trouble extracting every available business insight because they cannot share all unstructured data with their preferred IT vendors. Therefore, banks must come forward with new compliances and policies in terms of sharing and mining data with their IT partners.

Involving focus groups

For the study³⁸ most technology firms agreed to work closely with focus group teams in the HCAI product development life cycle. Both the technology firms and the focus group firms believed that involving focus group teams would improve the quality and the effectiveness of the HCAI-enabled products, which, in turn, would enrich the customer experience significantly. Most of the focus group firms, on the other hand, were quite open-minded and willing to collaborate with the banking software firms, FinTech firms and banks. Surprisingly, not all the participating banking software firms worked closely with the focus group team. The survey outcome showed that it is preferable to devise a collaboration strategy between the banks, IT partners and vendors and the focus group firms to collaborate closely in the AI-enabled product development journey.

CONCLUSION

The financial industry is changing rapidly owing to the operation of several factors such as increasing digitalisation, penetration of technology firms into the banking business that offer a wide range of services, and integration of social media as one of the payment platforms. Such a transformation provides a wide range of options for customers to perform various banking transactions. As a result, customers are attracted and switch easily to other service providers. This has posed a huge threat to banks, causing them to lose market share to non-banking tech firms. Banks should therefore adopt more proactive measures to foster awareness and to better understand the value of AI, capturing and processing human emotions and human minds by practising a co-development mindset with their IT partners and vendors. It is recommended that banks adopt a robust framework to design and develop HCAI-enabled products and services that provide a positive customer

experience. A digital transformation journey that includes HCAI will allow banks to remain competitive across the financial services landscape.

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