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Black Fintech

How Financial Technologies Learned to Manage Human Behavior

Book One

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Financial technologies promised access, speed, and fairness, and fulfilled some of those promises. At the same time, they learned to manage a person's behavior before that person has time to notice it. The author worked within the industry for more than ten years, designing lending products and scoring models, and examines the mechanism from within, without denunciation and without excuses. Most of the mechanisms described arose without malicious intent: harm comes not from intention, but from the combination of locally rational decisions made by people who, more often than not, did not see the whole picture. But not all of them—the later chapters deal with outright deception, illegal lending, and entire industries built upon it.

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From the Author

This book was born not in the silence of libraries, but amid the noise of bugs, phone calls, broken integrations, and emails beginning with the subject line ‘URGENT’. It grew out of practical experience in designing and developing fintech products in different countries, out of negotiations with banks and payment providers, discussions of lending strategies, analysis of delinquency, and attempts to understand why changing a few parameters within a system sometimes alters the behavior of hundreds of thousands of people in entirely unexpected ways.

As I worked in fintech for more than ten years and accumulated practical experience, I began to notice how similar these processes proved to be across different markets. Currencies, regulatory requirements, the names of banks, financial habits, and the appearance of applications changed, but the internal logic of digital financial systems retained much in common. Product teams sought to shorten the customer journey and increase conversion, risk analysts looked for new ways of predicting customer behavior, marketers tried to bring the user back into the application, and developers turned all of this into functioning technological infrastructure. Each individual decision had an entirely rational explanation, namely to make the product faster, more convenient, safer, or more profitable. Yet it was precisely the combination of these factors that began to change not only financial services, but also the environment within which a person interacts with money.

In our time, technology has long ceased to be merely a tool for automation. Today, it largely determines how a person gains access to money, makes purchases, uses credit, manages savings, and makes financial decisions. Fintech has made many services faster, more accessible, and more convenient, while processes that until recently required a visit to a bank, paperwork, and a long wait now take a few minutes or even seconds. This is one of the unquestionable achievements of the modern digital economy, but as old barriers were

removed, consequences also began to emerge that are considerably harder to see and measure using familiar business metrics.

One such noticeable change was the gradual disappearance of the pause between a person's desire and their financial action. Previously, infrastructure was slow and inconvenient, but its imperfections inadvertently left time in which one could reassess what one could afford, decide against a purchase, or simply put off the decision until the following day. One had to wait for a loan to be approved, sign documents, physically hand over money, or at least see the moment when it was debited from the account. The digital economy is steadily narrowing this space. A loan can be obtained with a few touches on a smartphone screen, installment payments are offered at the very moment of purchase, a subscription renews automatically, and a payment is confirmed by a simple touch of a finger or by biometrics. Today, a financial transaction ceases to be perceived as an action in its own right and becomes part of a continuous user journey.

At the same time, the amount of information available to the platform itself is also changing. To assess a person, it is no longer enough for the system to know their income, credit history, or the amount of their current obligations. Modern financial platforms are capable of taking into account transaction patterns, activity within the application, the speed at which an application form is completed, responses to offers, and a multitude of other indirect signals. These data form a digital profile that makes it possible to assess risk and predict a person's subsequent behavior much more accurately, namely the likelihood of making a purchase and returning to the application, taking out a new product, or responding to a particular notification.

A financial platform acquires the ability not merely to serve a decision that has already been made, but also to participate in shaping the environment within which that decision arises. The sequence of screens, the amount of information available, the moment at which an offer is highlighted, and the number of actions required before taking out a loan or making a purchase become part of the architecture of choice. Each element on its own may seem insignificant and have a perfectly understandable product rationale, yet together they are capable of noticeably influencing the decision a person ultimately makes.

As a result, the boundary between convenience and influence begins to blur. A good digital product should remove unnecessary actions, shorten the user journey, and make complex processes easier to understand. Yet this very same logic can imperceptibly narrow the space for a conscious decision. The more accurately a system understands a person's behavior and the less effort a financial action requires, the harder it becomes to determine where assistance to the user ends and influence over their choice begins. A technically flawless product is capable of simultaneously delivering real benefits and nudging a person toward decisions whose long-term consequences they do not have time to assess fully at the moment of making them.

This technology in itself is neither good nor bad. Digital systems do not emerge on their own and almost always reflect their creators' conceptions of efficiency, risk, profit, convenience, and the permissible limits of influence over the user. Behind the algorithm lie a business model, a product strategy, a system of metrics, and a multitude of decisions made by individual employees. The consequences of fintech's development therefore cannot be explained solely by an intention to manipulate customer behavior in some way. Let me make a qualification at once: this is not true of everything that will be discussed. The later chapters of the book describe fraudulent schemes, illegal lending, and entire production sites of deception, where intent is direct and harm is planned, and it would be wrong to extend an explanation based on unintended consequences to them. But for the greater part of the industry discussed in the early parts, something else is considerably more interesting. The question is how thousands of entirely rational decisions, made to increase conversion, reduce risk, improve speed, and enhance the user experience, together create an economic environment capable of changing the financial habits of millions of people.

Within this paradigm, it therefore becomes increasingly difficult to regard fintech solely as an industry of payments, lending, banking applications, and investment services. It is gradually turning into a considerably broader infrastructure that not only enables the movement of money, but also influences a person's attitude toward consumption, credit, risk, waiting for a decision, and the very availability of financial resources. The more deeply this infrastructure penetrates everyday life

and the less noticeable it becomes to the user, the more important it is for us, the creators of fintech products, to understand how efficiently it works and how it changes the behavior of the person within it.

This book is written for those who create, develop, and regulate such systems, for product managers, developers, designers, analysts, risk teams, entrepreneurs, investors, and regulators. In a broader sense, however, it is intended for everyone who is trying to understand how the digital economy changes a person's relationship with money and where the boundary lies between technological convenience, commercial efficiency, and influence over human choice.

Black Fintech is not an attempt to demonize technology or to present the financial industry exclusively from its negative side. Rather, it is a desire to look at it without the customary technocratic optimism and to understand processes that rarely find themselves at the center of presentations, reports, growth metrics, and conversations about innovation. Because behind the speed of loan disbursement, rising conversion, the accuracy of algorithms, and improvements in the user experience, there is always a person, and the consequences of the systems we have created are far from always confined to the indicators we are accustomed to seeing in databases.

Introduction

The digitalization of finance has changed not only the ways in which payments are made, loans are obtained, or capital is managed. Another, considerably more important change has taken place here. Along with money, the mechanisms of access, assessment of its owner, and control over the actions being performed have moved into the modern digital environment. Financial infrastructure has ceased to perform an exclusively technological function and has turned into one of the elements of the social environment within which a person's economic freedom is determined.

When cash predominated in everyday payments, many purchases left the bank with considerably less information about a person. The handing over of banknotes did not in itself create a banking record of who was paying with them, where, or why. The bank could see account transactions and assess credit risk, but it did not receive so detailed and continuous a stream of data about the customer's everyday purchases. With the spread of digital payments, everything is organized differently. More and more actions leave data behind, and the ability to perform the next transaction increasingly depends on the results of processing those data.

In the modern world, the very nature of financial power is changing. Increasing importance attaches not only to the ownership of money, but also to control over the infrastructure through which a person gains access to it. A bank, a payment system, a lending platform, or another digital environment is capable of setting limits, declining transactions, changing the terms of service, recalculating the level of risk, or completely restricting access to particular financial instruments. Moreover, a substantial proportion of such decisions are made automatically and almost instantaneously.

In such a system, the algorithm becomes more than a tool for processing information. It acquires the ability to determine what action is available to the user, on what terms it can be performed, and what level of risk is associated with a particular person. A scoring model decides who will be granted a credit limit. A fraud prevention system determines which

transaction looks suspicious. Compliance mechanisms can stop a transfer, while personalized models can determine which product will be offered to a particular user and at what moment.

Individually, each of these mechanisms, in its lawful application, addresses an understandable and necessary task. The lender needs to manage risk, the regulator to combat fraud and money laundering, and the payment system to ensure the security of transactions. Their combination within a single digital infrastructure, however, creates a qualitatively new environment in which observation, assessment, and the ability to perform a financial action are technologically linked to one another.

Prediction in itself is not new to the financial system: lenders have long assessed the probability of a debt being repaid. Digitalization changes the scale and speed of this work. Modern models predict not only the risk of default, but also the probability of fraud, a repeat purchase, customer churn, or a response to a particular offer. Financial infrastructure expands the range of events being predicted and links assessments of future behavior ever more closely to current decisions about the user.

At the same time, a question arises about the limits of such assessment. The more decisions are handed over to algorithms, the harder it becomes to determine where the management of financial risk ends and the management of a person's opportunities begins. A model error in such a system means more than an inaccurate prediction. It may lead to a transaction being blocked, a change in the terms of service, or restricted access to services, while the user is far from always able to understand exactly which data and relationships led the system to that decision.

The subject of this book is considerably broader than individual technologies, banking applications, or lending algorithms. It concerns the formation of an infrastructure that simultaneously stores money, observes its movement, assesses the owner's behavior, predicts subsequent actions, and, on the basis of those predictions, determines the opportunities available to that person.

The problem of the digitalization of finance lies not only in the existence of algorithms as such. Most of them are created and operate to address entirely rational and necessary tasks. They make the financial system faster, safer, and more efficient. What matters is something else. The question is what powers we are gradually handing over to this infrastructure, on the basis of what data it makes decisions, how transparent those decisions are, and what options remain for a person if the system makes a mistake.

Since this discussion runs throughout the book, it makes sense to agree at the outset on the meaning of its central concept. By the management of behavior, I do not mean coercion. I mean a systematic change in the probability that a person will make a particular decision, achieved through the design of the interface, the choice of the moment of contact, personalization of the offer, conditions of access, pricing, and the algorithmic selection of what a person will see at all. Such techniques can preserve the formal possibility of choice while changing its conditions. Taken together, they change the distribution of outcomes across a large sample of people, and it is precisely this shift in probabilities, rather than an individual transaction, that constitutes the subject of the book.

It is also useful to distinguish at once between five mechanisms that public discussion usually merges into a single word. Prediction assesses the probability of a future event and, in itself, changes nothing in a person's position. Selection determines who will enter a particular group and what approach will be used toward that group. Recommendation offers an option, leaving the choice to the person. Choice architecture defines the environment in which a decision is made: the range and presentation of options, their order, default settings, and the effort required to choose. Restriction directly closes off some possibilities. These mechanisms can be combined, but they differ in the degree of intervention, in their legal consequences, and in who is responsible for them, so in what follows I try to call each by its own name, rather than by the general word ‘management’.

For the same reason, the book maintains, wherever possible, a consistent sequence in describing how an automated financial decision works. First, there are data, that is, recorded features. From them, a

model is built that produces a score or a probability. The score is not in itself a decision. A decision emerges when an organization establishes a rule, that is, a threshold, a policy, or a procedure that turns a number into an action. Only then is that action carried out in a particular interface, where the person finally sees it. The phrase ‘the algorithm decided to decline’ almost always describes at least three different events joined into one and conceals the main point, namely that it is the organization, not the model, that sets the threshold and the rule. Where the abbreviated formulation does nevertheless occur in the text, it is used as shorthand, not as a claim that the decision was made by a machine.

The same caution also governs the treatment of the verb ‘to know’. A system knows nothing about a person. It observes features, records them, compares them with the histories of other people, assesses, infers, and predicts. The distinction here is not stylistic. An observed feature may be correct and the conclusion drawn from it mistaken, and it is precisely in the gap between these two statements that most of the problems described later arise.

Finally, it is worth distinguishing between four different statuses of any sensitive feature under discussion. It is one thing for it to be technically possible to calculate that feature. It is another for it actually to be collected. A third is whether its collection and use are legally permissible in a particular jurisdiction. And a fourth is whether it is actually used in decisions about people. Public discussion of fintech constantly fuses these four levels, turning a research demonstration into a description of industry practice. Where I am aware of confirmed cases of use, I try to cite them; where the discussion concerns a technical possibility, this is stated explicitly.

Three methodological qualifications apply by default in what follows. A stable statistical relationship between behavior and an outcome does not mean that one causes the other, and a coincidence in time between the emergence of a technology and a change in habits does not prove that the technology created those habits. A feature that improves a model's accuracy remains a feature, not a property of the individual: the score describes a probability, not a person, and the high predictive power of an individual variable says nothing about either its

permissibility or the fairness of its use. And finally, the accuracy of a model is not a moral argument. Strong performance on training data does not yet prove the quality of predictions for new cases. Testing on data that were not used in training and tuning helps to assess that ability. But even an accurate prediction may reflect social inequality and does not prove the fairness of a decision based upon it.

Black Fintech examines the digital financial environment from precisely this perspective, as an infrastructure that ceases merely to serve economic actions and acquires the ability to determine the conditions in which they become possible at all.

Part I. The Origins of Fintech

Today, financial infrastructure is perceived by most of us as a natural and familiar part of everyday life. Money can move between countries in a matter of seconds, lending products are arranged automatically on the basis of accumulated customer data, and a substantial proportion of decisions are made by systems that the user never sees directly and whose existence they most often do not even think about. The interface has replaced the bank counter, the push notification has become more familiar than the paper receipt, and the algorithm increasingly performs the work of an employee who once made the decision personally, assessing the customer through conversation, the documents presented, their business reputation, and the employee's own perception of the person's reliability.

From the outside, it may seem that the history of financial technologies began only very recently, with smartphones, mobile banking, QR codes, and digital platforms that turned the phone simultaneously into a wallet, a payment terminal, and a lending office. Yet a substantial proportion of the processes that define modern fintech arose long before the internet and mobile communications. For centuries, the financial system learned to formalize trust and carry it beyond personal acquaintance, first through promissory notes and accounting ledgers, and then through banking registers, credit histories, databases, and scoring models. Ultimately, this led to the emergence of digital systems capable of assessing a person on the basis of an enormous number of parameters grounded in their obligations, financial position, and behavior.

Financial life, meanwhile, retained its familiar material forms: coins and banknotes, cash counters, stamps and signatures on paper contracts that were filed in archives and kept for years as evidence of actions performed. The development of banking and lending, however, required mechanisms capable of operating over considerably greater distances and with a far larger number of participants. Human memory,

personal reputation, and trust within a small community were no longer sufficient. Banks, trading houses, and states needed to record obligations, confirm transactions, transmit information between cities and countries, assess the reliability of unfamiliar people, and manage risk where these parties might never meet in person.

It was precisely this ability to scale trust that became one of the most important conditions for the development of modern fintech. Personal acquaintances did not disappear at once and retained their importance for a long time, yet alongside personal ties, mechanisms emerged that made it possible to replace direct knowledge of a person with information about them. A document confirmed identity and an obligation, an entry in an accounting ledger recorded a debt, a banking history showed past relations with a lender, and a centralized register made it possible to obtain information that had previously existed only within a limited circle of people. Trust ceased to depend exclusively on human intuition and became a reproducible procedure that could be applied to thousands, and later to millions, of participants in the economic system who did not know one another.

The next stage was the transformation of accumulated information into a tool for assessing risk. It proved insufficient for the financial system to know what a person had done in the past. It was necessary to understand how likely they were to behave in a particular way in the future. Risk categories, statistical relationships, and probability models began to take shape from histories of payments, debts, income, and the fulfillment of obligations. This was how a logic emerged that would subsequently become one of the fundamental principles of digital fintech. A person's behavior can be described through data, compared with the behavior of other people, and, on the basis of the patterns identified, an attempt can be made to predict their next action.

This change had far deeper consequences than a simple improvement in bank accounting. Financial infrastructure ceased to be a system that merely stores money, records obligations, and enables their transfer between participants. It acquired another function, namely to assess a person. First through reputation and documents, then through credit history and statistical features, and later through mathematical models and digital data. Each new technology increased the distance over which

financial trust could exist, but at the same time expanded the amount of information the system needed to make a decision.

Thus, the history of fintech cannot be reduced solely to a sequence of technological inventions. The telegraph, payment cards, ATMs, electronic databases, the internet, and smartphones did indeed change the speed and the ways in which money moved, yet behind this technological evolution another, no less important process was taking place. The financial system was learning to turn information into trust, which in turn was transformed into formalized assessment and decisions about to whom, on what terms, and to what extent access to financial opportunities should be granted.

This part of the book is devoted to a time when money had not yet become digital in the familiar modern sense, but the architecture of the future system was already taking shape within banking ledgers, debt records, telegraphic transfers, the first centralized registers, and mechanisms of financial accounting. It is the history of a transition from personal trust to institutional trust, and then to statistical and algorithmic trust. The history of how the development of financial infrastructure separated money from its physical medium and turned it into information existing within an increasingly complex system of trust, assessment, and decision-making.

Chapter 1. When Trust Became a System

Several years ago, during a discussion of another version of a scoring model, I witnessed an argument that at the time was perceived as an ordinary work discussion, although later I returned to it more than once. Our product analyst had noticed an unexpected relationship. Customers who took longer to complete particular stages of the application form showed, on average, a lower level of early delinquency. Initially, the time taken to complete the form was tracked as an ordinary product metric that made it possible to identify problem areas in the funnel, but the pattern that had been discovered interested the team responsible for credit risk and the development of the scoring model.

The mere fact of correlation did not mean that the new feature should be included in scoring. One of the modelers showed that this feature had additional predictive power even after traditional borrower characteristics had been taken into account. Another drew attention to its stability on new samples and to the possibility that the result depended on factors not directly related to credit risk. The speed at which the form was completed could be determined by the device, the quality of the internet connection, the source of traffic, the customer's age, previous experience of using the product, or the design of the interface itself. A change in the sequence of screens, a reduction in the number of fields, or the addition of automatic data entry could be enough for the pattern that had been identified to disappear along with the old version of the form.

Quite quickly, the discussion moved beyond a single feature. The team examined the time taken to complete individual stages, returns to previous fields, the number of corrections, the sequence of actions, and other signals arising directly in the process of filling out the application. Some of them did indeed show a relationship with credit risk; others proved unstable or lost their predictive power on new samples. The main question was no longer whether a statistical relationship could be found, since a sufficient volume of data yields many such relationships, but what exactly lay behind a particular signal, how stable it was over

time, and whether it provided additional information after the model had accounted for traditional customer data.

At one point, one of the participants in the discussion said that a phone sometimes tells us more about a customer than the application form itself. From the perspective of modeling, this was, of course, an exaggeration. Application data, credit history, information about income and existing obligations had not disappeared and remained the foundation of risk assessment. Yet the phrase itself described quite accurately the shift taking place in the financial industry. The system was acquiring the ability to analyze not only what a person consciously reported about themselves, but also the digital footprint arising in the course of ordinary interaction with a product.

For modern fintech, such practice has long ceased to be unusual. Product analysts study the user journey and the causes of lost conversion, risk teams look for additional indicators of creditworthiness, fraud prevention specialists analyze devices and behavioral anomalies, and modelers and data scientists test whether the signals identified possess sufficient predictive power and stability to be used in automated decisions. The same data may have entirely different meanings. Unusually rapid completion of a form may be the result of a convenient interface, a sign of an experienced user, or a signal of automated fraudulent activity. The value of data is determined not by the number of features collected, but by the system's ability to interpret them correctly in a particular context.

Here, one of the fundamental changes in modern financial infrastructure becomes apparent. For most of history, a lender tried to obtain information about a person directly, talked to them, examined documents, learned about their reputation, and assessed their property and their ability to fulfill an obligation. Later came credit bureaus, centralized registers, and statistical models that made it possible to make decisions on the basis of accumulated history. The digital environment added another layer of information to this, namely a person's behavior at the very moment of interaction with the system.

The history of fintech therefore begins not with smartphones, mobile banking, artificial intelligence, or cryptocurrencies. Beneath the modern

technological layer lies a considerably older task, namely how to make a financial decision concerning a person whom you do not know personally, and to what extent the available information about them can be trusted.

Over the centuries, the ways of answering this question changed along with the scale of the economy. While transactions took place within small communities, personal acquaintance and reputation played a substantial role. The expansion of trade required written obligations, accounting, and intermediaries capable of confirming the reliability of the parties to a transaction. The development of the banking system led to formalized verification procedures, centralized registers, and credit histories. Mass lending required statistical methods of risk assessment, and the digital economy added to them an enormous body of data about human behavior.

Each successive stage made it possible to reach decisions more quickly and about a considerably greater number of people, but at the same time increased the distance between the person making the decision and the person being assessed. Personal knowledge was supplemented by a document, the document by an entry in a register, the register by a statistical model, and the model by an algorithmic system capable of processing thousands of features with almost no direct human involvement.

This transformation of trust is of greater interest to the history of fintech than the sequence of individual technological inventions. Money, credit, and payment infrastructure could take different forms, but the financial system invariably faced the same task, namely to determine whether the other party could be trusted and on what terms that trust was permissible.

Modern scoring has taken this logic to a new level. Instead of a loan officer's personal impression, the system uses data; instead of reputation within a community, a history of financial behavior; and instead of human judgment, statistical probability. A decision that was once made after a conversation between two people can today be made in a fraction of a second on the basis of information, most of which will never be shown to the user.

That argument long ago about the speed of completing an application form was therefore, in reality, more than an argument about the quality of another feature in a scoring model. Behind it stood a much older question that the financial system has been asking throughout its history. How do we understand whether we can trust a person we do not know? Only the ways of seeking an answer have changed.

1.1. Money as an Agreement. The Value of Shared Recognition

If we look at a modern mobile banking application, we can notice something rather strange. The screen displays ordinary numbers, a few icons, a transaction history, and buttons for making transfers and payments. A person pays for a subscription, sends money to an acquaintance or a family member, repays a loan, or checks a balance, almost without thinking about what is happening at that moment. In the few seconds between pressing the button and confirmation of the transaction, the system manages to check the user's access, the payment parameters, and the established limits, carry out fraud analysis, update the necessary records, exchange messages with other systems, and record the result of the transaction. Most of these processes remain invisible to the user. They see the balance and the result of the transaction and perceive the information displayed in the application as confirmation that the money really is in their account.

Such trust seems natural largely because financial infrastructure has existed around us for so long that we have almost ceased to perceive it as a system created by people. The very possibility of storing value in the form of a universally recognized token or record is far less obvious than it seems today. Before modern banks, state guarantees, and centralized accounting systems, a substantial proportion of economic relations existed directly within human communities. People exchanged goods and labor, lent resources to one another, settled accounts with each other, and agreed on future obligations. The possibility of such relations depended largely on memory, reputation, personal acquaintance, and the ability to keep the promises one had made.

As long as a community remained small, such a system could operate with relative stability. People knew who owed whom, who honored agreements, who could be trusted, and whom it was better not to deal with. In many cases, debt was closely connected with particular people and the relationships between them. Information about obligations was retained in the memory of the members of the community and sustained by the social ties that existed within it.

As settlements grew and trade developed, the capabilities of such a mechanism became insufficient. Economic relations arose between people who knew each other poorly or had never met before. Distances and the number of participants in trade increased, and obligations themselves became more complex. Human memory and personal reputation could no longer remain the only way of confirming agreements. It became necessary to record obligations in such a way that information about them would survive independently of particular people's memories and could be recognized by other participants in economic relations.

Different societies addressed this task in different ways. Grain, metals, shells, furs, and other goods were used to store and transfer value. Debt obligations existed, along with various ways of recording them. Coins made it possible to standardize payments and simplified exchange between people who might know nothing about one another. The forms of money and methods of accounting differed considerably depending on the period and the society, yet a common principle was taking shape. Participants in economic relations recognized a particular object or record as confirmation of existing value and agreed to accept it in settlement.

Money is therefore difficult to regard exclusively as a physical object. Its existence has always depended on whether other participants in economic relations recognize its value and are prepared to accept it as a means of payment. A silver coin had its own value as a metal, but its role in the economy was determined by more than the amount of silver it contained. The value of the material from which a modern banknote is made has practically no connection with the denomination printed on it. In the case of a bank account, the familiar physical medium disappears altogether. A person owns not a set of banknotes located somewhere

inside the bank, but a right, recognized by the financial system, to dispose of a certain sum.

Yuval Noah Harari described money as one of the most universal systems of mutual trust created by humanity. In the modern digital economy, this idea becomes especially apparent. A person may go for weeks without holding cash in their hands and yet quite calmly perceive the balance in a mobile application as real value. They do not need to see the money itself or understand how banking infrastructure is organized. Confidence that the stated sum can be used to pay for goods, transferred to another person, or withdrawn from the account is enough.

Such trust extends both to the balance itself and to the actions of the financial system. A subscription may renew automatically, a credit limit is recalculated without the customer's involvement, and a salary arrives in the account according to an established schedule. An ordinary payment may pass through several banking and technological systems before the recipient sees the money in their account. The user usually does not know the route of the transaction and has no idea which organizations and information systems participated in the settlement. As long as the infrastructure works predictably, they have practically no need to understand how it is organized.

In recent years, I have had occasion to observe similar changes in some countries of Southeast Asia. People who, until relatively recently, had preferred to keep some of their savings in cash or gold began to perceive a mobile wallet as an ordinary part of everyday financial life. This transition rarely looked like a conscious decision to abandon one conception of money and adopt another. Rather, attitudes toward the technology itself were changing. People noticed that payments through an application were becoming more convenient and made it possible to pay for goods, receive money, and transfer it to other people more quickly. As this experience accumulated, the mobile wallet ceased to be perceived as an additional financial instrument and became a familiar way of storing and using money.

The nature of money itself has changed considerably less than its outward appearance. Throughout history, the ways of storing and

transferring value, the mechanisms for confirming obligations, the intermediaries, and the technologies they used all changed. The need for that value to be recognized by other participants in economic relations remained constant. What changed substantially was the way of confirming what belonged to whom, who owed whom, and which obligations had already been fulfilled.

When economic relations existed within small communities, a substantial proportion of this information could be retained in people's memories. As trade grew more complex, obligations began to be recorded on physical media, and more formalized methods of accounting came into use. The development of banks led to the emergence of complex systems for recording transactions and maintaining accounts. Digitalization transferred this process into information systems, where a single financial transaction may be reflected simultaneously in several independent accounting subsystems. The task itself, however, has hardly changed. The financial system still needs to establish reliably to whom value belongs, in what amount, and on what basis one participant can transfer it to another.

The history of money can therefore be regarded not only as the history of coins, banknotes, banks, and payment technologies. To a large extent, it is the history of the development of ways to record economic relations. Human society learned to preserve information about value and obligations so that it could exist independently of an individual person's memory and be recognized by people who had never met one another.

1.2. From Debt Tablets to Banking Ledgers

In recent years, I have quite often had to observe situations in which a transaction was complete for the user but remained unconfirmed for some time within the financial infrastructure. This usually became apparent during reconciliation between the bank, the processing system, and the platform's internal ledger. The user received a push notification of a successful payment, the merchant saw confirmation of a successful transaction, and the money was debited from the account, yet in individual accounting subsystems the transaction remained in an intermediate state for some time. Different systems had to confirm it and bring their records into agreement with one another.

During the launch of one payment route in Southeast Asia, I spent several days watching a team of engineers, risk analysts, and reconciliation specialists try to understand why some transactions successfully passed authorization but became stuck at the stage of final confirmation by the partner bank. For the user, the payment had already taken place. The processing system also regarded it as successful. The partner bank, however, had not yet completed its processing, so the data within the different systems did not match. While the team investigated the reasons for the discrepancies, it was especially clear how conditional the familiar notion of a completed financial transaction can sometimes be.

From the outside, such situations look like an ordinary technical failure. But within financial infrastructure, one quite quickly begins to notice a more fundamental problem. Modern money exists above all in accounting systems. It is not enough to show the user a new balance or send a message about a successful payment. The transaction must be recorded, recognized by the relevant parties to the settlement, and reflected in their systems. From the perspective of financial accounting, a transaction exists insofar as the system recognizes the corresponding record as valid.

This logic appeared long before digital banking, mobile applications, and payment APIs. As cities grew and trade developed, human memory became insufficient for keeping track of an ever-increasing number of economic relations. It was necessary to remember how much grain was

in storage, who had received goods, who had been granted a loan, what tax had to be paid, and what obligations were to be fulfilled after the next harvest. The more complex economic life became, the more important it was to preserve such information independently of the memories of individual people.

Some of the earliest known systems of written economic accounting appeared in Mesopotamia. Stocks and transfers of goods, taxes, loans, and debt obligations were recorded on clay tablets. A record made it possible to preserve the content of an agreement and check it later. An obligation no longer depended exclusively on what the creditor, the debtor, or the witnesses to the transaction remembered. It acquired material confirmation that could survive considerably longer than human memory.

The tablets themselves did not automatically create a debt. What mattered was the system within which the record was drawn up and recognized, as well as the parties to the transaction, witnesses, seals, and existing rules. Yet here a principle appears that would subsequently become fundamental to financial infrastructure. An economic obligation acquires a formal representation that can be stored, verified, and used in subsequent settlements.

As trade developed, the role of such records grew. Merchants had to keep track of goods in transit, settlements with suppliers and buyers, loans extended, payments received, and obligations to partners. Physical money continued to be used, but by no means every economic transaction required its immediate movement. For participants in trade, a recognized obligation was sufficient, one that could be fulfilled in the future or discharged against a counterclaim.

This process became especially apparent in medieval European trade. Merchant houses maintained relationships with partners in different cities and used credit, bills of exchange, and accounting records. Goods could remain in transit for weeks, while settlements between the parties to a single transaction took place in different locations and at different times. Under such conditions, the reliability of accounting became no less important than the availability of the coins themselves.

The development of banks reinforced the importance of this system. A customer's money could be reflected in a bank's ledger as an account balance, and a settlement between two customers of the same bank did not necessarily require a physical transfer of coins. The bank could change the entries in their accounts, reducing its obligation to one customer and increasing its obligation to another. For the parties to the transaction, the result was entirely real, although no money might physically have moved between them.

As banking developed, accounting itself also became more complex. The spread of double-entry bookkeeping acquired great importance, making it possible to reflect each economic transaction through related changes in accounts. Italian merchants used such methods even before Luca Pacioli systematized and described the principles of double entry at the end of the fifteenth century. The accounting ledger became more than an archive of completed transactions; it became a tool that made it possible to reconstruct a participant's financial position and verify the relationship between individual entries.

Here, an important characteristic of the banking system begins to take shape. A bank holds more than money. It holds information about rights and obligations, determines the state of accounts, and confirms the results of completed transactions. Its ability to perform this function depends on customers' confidence that records are kept correctly, funds really are available, and an account balance recognized today will retain its significance tomorrow.

As the banking system grew, internal accounting alone became insufficient. Banks had to settle with one another, maintain correspondent accounts, and reconcile mutual obligations. Clearing mechanisms and settlement systems appeared. A single transaction could be reflected in the records of several participants at once, creating a need to reconcile the results of processing between them. Financial infrastructure became more complex, but its basic task remained the same. It was necessary to determine what obligations existed, to whom funds belonged, and which records should be regarded as valid once settlement was complete.

The modern financial system has taken this principle to an enormous scale. Banks' core banking systems maintain bank accounts, processing centers process card transactions, payment gateways transmit messages between participants, and fintech companies' internal ledgers record the movement of funds within individual products. A single transaction may exist simultaneously in several information systems, each of which is responsible for its own part of the process.

Hence the role that reconciliation plays in modern financial infrastructure. If one system considers a transaction successful while another has not received confirmation or has recorded a different amount, a discrepancy arises. It may remain invisible to the user, but within the financial organization it is necessary to identify the cause, reconstruct the sequence of events, and understand which record reflects the actual state of settlement.

From this perspective, an ancient debt tablet, a banking ledger, and a modern digital ledger have much more in common than might appear at first glance. The technologies for storing information have changed, as have the speed of its transmission and the number of transactions the system can process. Yet the very need to record obligations and determine the actual state of settlement has remained intact.

The modern user rarely thinks about this. They open an application, see a balance, and perceive it as their money. Behind that number stands an entire system of records, rules, and confirmations that determines their right to dispose of the funds. Financial infrastructure has become so reliable and familiar that, for most people, the record has practically merged with the value itself.

The history of financial accounting is important for understanding modern fintech. Many processes that today seem exclusively technological address a very old task. The financial system must establish reliably who owes whom, to whom funds belong, which obligation has already been fulfilled, and which record should thereafter be regarded as valid. Several thousand years ago, clay tablets were used for this purpose. Today, the same task is performed by banking ledgers, processing systems, and distributed settlement infrastructure.

1.3. The Industrial Era. Money Moves as Information

Several years ago, during a discussion of an international payment integration, I observed a situation characteristic of modern financial infrastructure. The team was trying to understand why some cross-border transfers between several banks in Asia and Europe periodically became stuck in an intermediate subsystem. The money itself, of course, was not physically moving anywhere. We were discussing messages between systems, transaction statuses, bank confirmations, processing queues, and discrepancies in records.

One of the engineers remarked at the time that most modern financial infrastructure had long been working not with money itself, but with information about the right to dispose of it. Formally, he was speaking about a very specific technical problem, but the phrase describes well one of the principal changes in the history of finance. First, society learned to record obligations in accounting systems. Then it became possible to transmit information about those obligations over long distances considerably faster than the money itself could be moved.

The industrial era sharply accelerated this process. Cities, factories, and the volume of international trade grew, railways were built, and sea transport became faster. At the same time, postal services and the telegraph developed. Goods, people, and information began to move more quickly, and the financial system had to adapt to the economy's new speed.

In large commercial transactions, the physical movement of money had long ceased to be the only means of settlement. Bank accounts, bills of exchange, checks, and other instruments were used to establish and discharge obligations without constantly transporting coins and banknotes. The development of transport and communications, however, substantially increased the scale of such transactions. Goods might already be in another city or country while the documents needed to complete settlement were still in transit. The faster trade became, the more important it was to learn to transmit financial instructions at a comparable speed.

The development of the telegraph proved important for more than communication. The ability to transmit a message between distant points almost instantaneously created a new channel for financial transactions. Information about a transfer could now travel hundreds or thousands of kilometers without money being physically transported between sender and recipient.

In the United States, Western Union became one of the best-known examples of this transition. The company initially developed a telegraph network and launched a money transfer service in 1871.[1] The sender deposited funds at one office, after which information about the transfer was transmitted over the telegraph network, and the recipient could collect the corresponding amount elsewhere. For the customer, money was being transferred. Within the infrastructure, a message was being transmitted, followed by the recording of obligations between the participants in the system.

This distinction is fundamentally important for understanding the subsequent development of financial technologies. Money does not have to travel physically along the same route as information about a payment. Banks and other financial organizations may have their own settlement relationships, accounts, and netting mechanisms. The user, meanwhile, perceives what is happening as the movement of a certain sum from one point to another.

The telegraph allowed a financial instruction to move at the speed of information. Before this, the speed of settlement had depended largely on the physical delivery of documents and other media. A message could be received almost immediately after it was sent, and the financial system had to determine who was entitled to initiate such a message, how to verify its authenticity, and how to reflect the result in the accounts.

Alongside this, everyday financial culture was also changing. Bank accounts became more accessible, and checks came into widespread use in a number of countries. A person could pay another person or a company without handing over cash at the moment of the transaction. A check contained an instruction to the bank to pay the stated amount, while final settlement took place within the banking system.

At first glance, the difference from cash was small. One paper object simply replaced another. In substance, however, the principle of operation was entirely different. The value of a check was determined neither by the value of the paper nor by the mere fact of its existence. It had meaning only in connection with a bank account, the owner's signature, the sufficiency of funds, and the bank's willingness to carry out the instruction.

What a person handed to the recipient was not money as a physical object, but an instruction to the financial system to change the state of the accounts.

As the number of such transactions grew, banks had to create infrastructure for the mass processing of mutual claims. If customers of different banks wrote thousands of checks to one another every day, settling each one physically and separately was extremely inefficient. Banks could first determine their aggregate mutual claims and then settle the resulting net position. The development of clearing separated the individual user transaction still further from the physical movement of money.

In the second half of the twentieth century, the next stage began. Bank accounting was moving into a computing environment. Transactions that had previously required the processing of paper documents and the participation of employees were increasingly performed by electronic systems. Computers made it possible to store enormous volumes of records, update account balances more quickly, and automate transaction checks.

ATMs became one of the first mass-market interfaces of this new infrastructure. On June 27, 1967, Barclays installed a device at its branch in Enfield, in north London, that is usually called the first modern ATM.[2] For the customer, the change looked quite simple. Cash could now be obtained without approaching an employee at the branch. For the financial system, something else mattered. A person was beginning to interact directly with a technical interface that had to verify their right to perform the transaction and dispense money without the involvement of a bank employee.

The further development of bank cards, electronic payment networks, and automated transaction processing systems continued this process. Making a payment required the transmission of a standardized message, verification of the participant's authority, a decision from the relevant system, and a change in the accounting records. The speed of a financial transaction was becoming dependent on the speed at which information was transmitted and processed.

The modern cross-border transfer takes this logic to its limit. When a customer sends money from one country to another, their funds do not usually leave the bank account in the form of any physical object and set off after the recipient. Banks and payment systems exchange messages, change account records, use correspondent relationships, and settle with one another. The user sees the result of this process as a decrease in one balance and an increase in another.

The engineer's remark that financial infrastructure works with information about the right to dispose of money therefore describes the organization of the modern financial system quite accurately. Between the ancient record of a debt and the digital bank transfer, a fundamental transition took place. First, the record made it possible to preserve an obligation independently of human memory. The development of communications made it possible to transmit such information over a distance. Electronic systems made its processing almost instantaneous.

Here, the technological foundation of modern fintech takes shape. For the user, money exists as the state of an account and the ability to perform the next transaction. For financial infrastructure, it exists in the form of linked records, access rights, obligations, and messages between systems. Today, the speed at which money moves is determined largely no longer by the speed of movement of physical media, but by the speed at which financial systems can transmit, verify, and recognize information.