

Chapter 6: Technology in Community Banks

From mobile banking to online lending, financial technology is reshaping how customers want to bank and how banks can deliver products and services. For community banks at the forefront of this movement, the latest technology-enabled products and services have become a necessity rather than a luxury. Other banks, meanwhile, have charted a more conservative course, adopting new technology only after it has settled into mainstream banking. Somewhere in between the early and late adopters lie the thousands of community banks that operate under different business models in different environments throughout the United States.

This chapter differentiates community banks on the basis of their technology offerings, thereby contributing to a better understanding of the factors that influence, and are influenced by, banks' decisions to adopt technology. Existing research in combination with responses to the Conference of State Bank Supervisors 2019 National Survey of Community Banks reveals several factors that were related with the adoption of technology. Among these factors were a bank's characteristics, its economic and competitive environment, and the attitudes and expectations of its leadership. In particular, larger

community banks and those with higher revenues to assets were most likely to have adopted certain technologies.

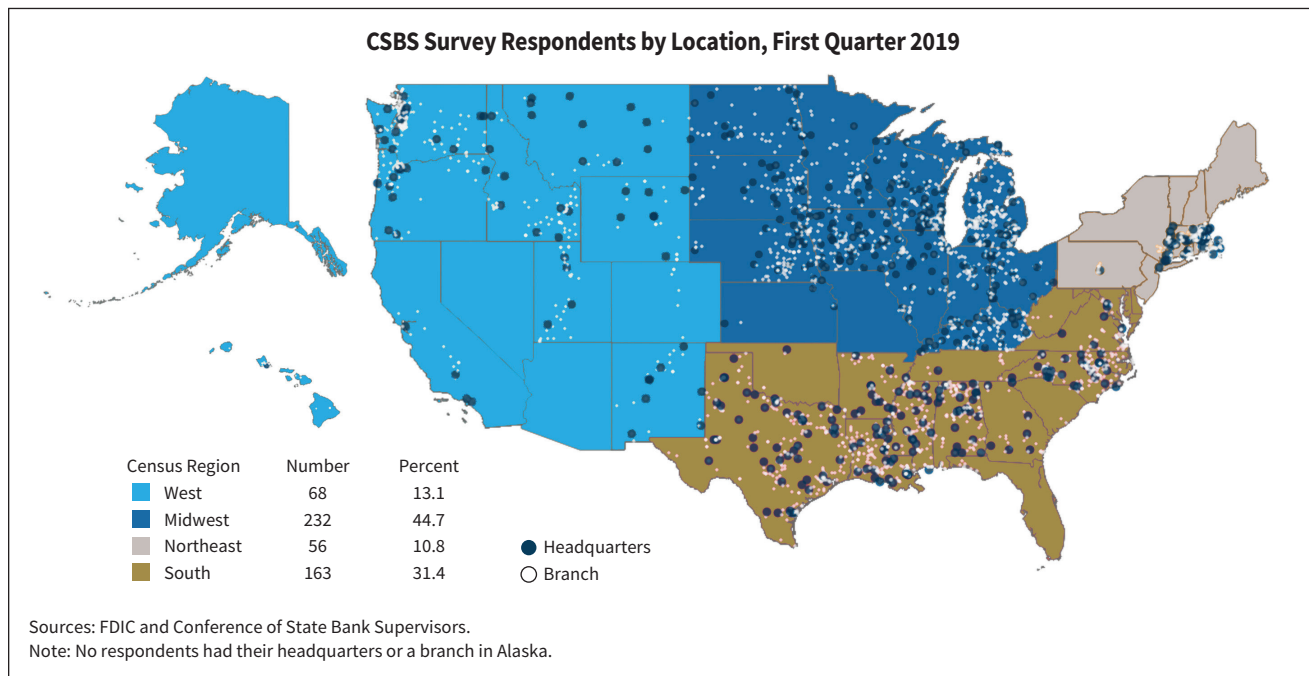
Future research into technology adoption will broaden our understanding of the key drivers, barriers, and risks associated with financial technology and its likely effect on the continuing success of community banking.

CSBS Survey Data Offer a Representative Look at Community Banks

Since 2015, the Conference of State Bank Supervisors (CSBS) has conducted an annual national survey of community banks to quantify underlying trends and issues of importance. The 2019 survey, conducted between April and June of that year, generated responses from 519 institutions that met the definition of "community bank" using Call Report data as of March 31, 2019.¹

The banks examined in this chapter generally reflected the overall population of community banks at the time of the survey. Respondents were spread across the country, with branches in 43 states and the District of Columbia (Map 6.1). Table 6.1 shows that in distribution by size (as measured by total assets and number of branches),

Map 6.1



¹ For its survey, the CSBS defined "community bank" as an institution with less than \$10 billion in total assets. Differences between that definition and the definition used in this study resulted in the exclusion of 52 institutions from the findings discussed in this chapter, relative to the summary of the survey results published by the CSBS.

Table 6.1 Comparison of Surveyed Banks and All Community Banks by Asset Size and Number of Branches, First Quarter 2019

(Percent of Total)	Community Banks	
	In Survey	All
Total Assets		
Less Than \$100 Million	18.3	25.1
\$100 Million to \$200 Million	24.9	23.9
\$200 Million to \$500 Million	30.1	29.2
\$500 Million to \$1 Billion	14.1	12.6
More Than \$1 Billion	12.7	9.3
Number of Branches		
1 Branch	12.1	19.1
2 to 4 Branches	38.5	39.7
5 to 9 Branches	28.5	24.6
10 to 19 Branches	14.8	11.7
20 to 49 Branches	5.2	4.3
50 or More Branches	0.8	0.7

Sources: FDIC and Conference of State Bank Supervisors.

the surveyed community banks generally reflected the distribution of all community banks. As of March 31, 2019, on average, community banks in the CSBS survey held about \$36 million more in assets than all community banks, and operated one more branch than all community banks; these differences, however, were comparatively small—4 percent and 12 percent of a standard deviation, respectively.²

Adoption of Certain Technologies Varied Among Community Banks

Technology has a long history in banking, yet the data necessary to quantify its adoption and use are hard to obtain, particularly data on community banks. On the Call Report, banks do not report their use of, or spending for, technology, and information available through other regulatory filings is often not comparable across entities or is not required of many smaller institutions.

Therefore, this chapter relies on responses to the CSBS survey that indicated whether a community bank offered specific technology-enabled products or services at the time of the survey. The products and services covered

² Unless otherwise specified, this chapter uses Call Report data from March 31, 2019, the quarter immediately preceding the collection of survey data. This contrasts with other chapters of this study, which generally use data through year-end 2019.

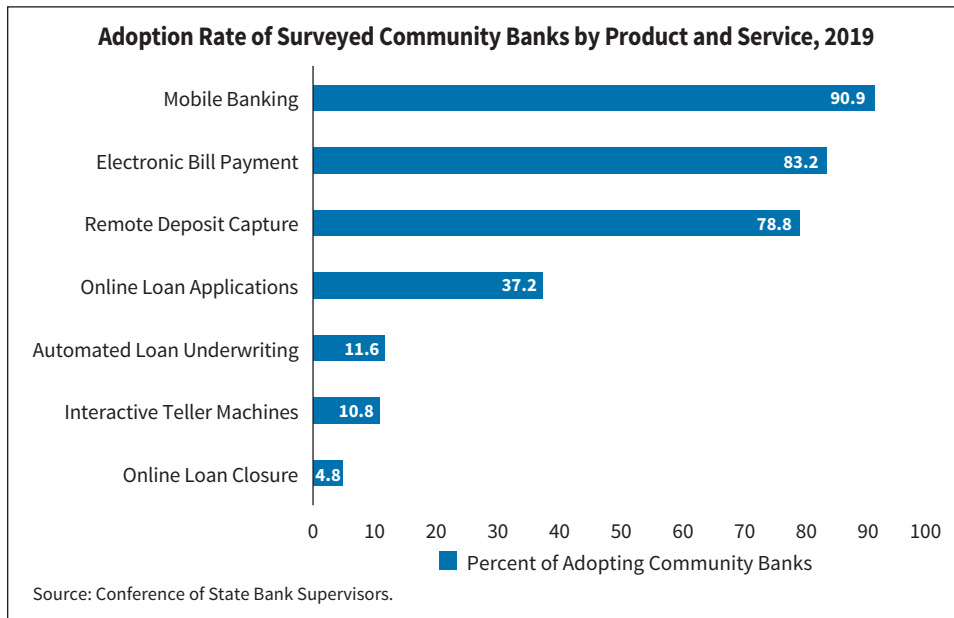
by the survey included three that help banks in lending (online loan applications, online loan closure, and automated loan underwriting) and four that provide additional functionality to deposit accounts among other functions (remote deposit capture, interactive teller machines (ITMs), electronic bill payment, and mobile banking). A general description of each technology is included in Box 6.1. Several of the technologies date from the early to middle 2000s,³ whereas others, such as online loan closure and ITMs, emerged in the middle to late 2010s. Overall, among community banks participating in the 2019 CSBS survey, adoption rates ranged from 4.8 percent for online loan closure to 90.9 percent for mobile banking (Chart 6.1).⁴

In addition to looking at whether community banks offered a technology-enabled product or service, the chapter combines the seven technology offerings into one general technology-adoption measure. Specifically, the measure categorizes each community bank as a “low,” “medium,” or “high” adopting bank on the basis of the number and type of technology products and services (out of the seven included in the survey) that the bank offered at the time of the survey. Products and services that were less common (those with an adoption rate of less than 50 percent) received greater weight than those that were more common (those with an adoption rate of greater than 50 percent) so that banks that were “early adopters” of one or more less common technologies were more likely to be defined as high-adopting banks. For more detail, see Box 6.1.

³ For example, Wells Fargo was one of the first U.S. banks to introduce mobile banking in 2001, although the bank discontinued the service shortly thereafter. Other large banks, including Citibank, Bank of America, and Wachovia, added similar services beginning in 2006 and 2007. See Hamilton (2007). First Tennessee Bank in Memphis was one of the first financial institutions to implement remote deposit capture in 2003 as a way to expand its deposit base. The Check Clearing for the 21st Century Act, which took effect in 2004, paved the way for the further development of remote deposit capture by allowing image-based “substitute checks” to serve as the legal equivalent of an original check. See FDIC, “Remote Deposit Capture: A Primer” (2009).

⁴ In addition to stating whether their bank offered a specific technology-enabled product or service, survey respondents indicated whether they planned to offer, or to exit or substantially limit, the product or service within the next 12 months. For purposes of this chapter, adoption status includes only a bank’s reported offering at the time of the survey and does not account for intentions.

Chart 6.1



Box 6.1. Process for Creating a General Technology-Adoption Measure

The CSBS survey asked community banks to state their intentions toward the seven technology-enabled products and services listed below.^a

Automated loan underwriting – platform that retrieves and processes borrower data through a computer-programmed underwriting system to arrive at a logic-based loan decision

Electronic bill payment – ability for customers to transfer funds from a transaction or credit-card account to a creditor, vendor, or individual

Interactive teller machines – machines that provide customers with direct, real-time access to a bank teller via a video link

Mobile banking – service that allows customers to access account information and conduct transactions with their institution remotely via a mobile device (cell phone, tablet, etc.)

Online loan applications – portal for potential borrowers to electronically share items, such as identifying information, income, and bank account data, needed to process a loan application

Online loan closing – ability to electronically sign and complete documentation necessary to finalize a loan (note that some states do not allow full remote online notarization)

Remote deposit capture – service that allows a customer to remotely scan checks and transmit the images or data to a bank for posting and clearing

Each of these technology products and services were categorized as either “more common” (if offered by more than half of community bank respondents to the CSBS survey as shown in Chart 6.1) or “less common” (if offered by fewer than half of community bank respondents).

Table 6.1.1 includes a 5x4 matrix that depicts the number of community banks that offered different combinations of “more common” and “less common” technologies. For example, the cell in the first numbered column and row indicates that 14 community banks in the survey offered none of the “less common” or “more common” technologies; whereas, the last numbered column and row indicates that two community banks offered all four of the “less common” technologies and all three of the “more common” technologies.

continued on page 6-4

^a The definitions included in this chapter are for informational purposes. Community banks participating in the CSBS survey used their own interpretations when indicating whether the bank offered a product or service.

Box 6.1, continued from page 6-3

Next, each cell and its corresponding banks were labelled “low-adopting” (tan-shaded cells in Table 6.1.1), “medium-adopting” (dark gold-shaded cells),” or “high-adopting” (dark blue-shaded cells.) The labels were chosen in a manner that divided banks evenly among the categories, to the extent possible, to allow for more equal comparisons across groups. Labels were also chosen so that “high-adopting” banks were more likely to offer a greater number of technologies and be early adopters of “less common” products and services. The result of the process by which the low-, medium-, and high-adopting schema was arrived at is depicted in the right-hand table of Table 6.1.1.

Table 6.1.1 Number of Technologies Offered by Adoption Category, 2019

“More Common” Technologies	“Less Common” Technologies					Total
	0	1	2	3	4	
0	14	2	1	0	0	17
1	32	5	1	1	0	39
2	78	28	8	0	1	115
3	154	132	48	12	2	348
Total	278	167	58	13	3	519

	Number	%
Low-Adopting Banks	131	25.2
Medium-Adopting Banks	193	37.2
High-Adopting Banks	195	37.6

Sources: FDIC and Conference of State Bank Supervisors.

Research and Survey Responses Link Several Factors With Technology Adoption

Existing research has identified several characteristics that differentiated banks that adopted earlier technologies from those that did not. Studies of the ATM and internet banking, for example, found that larger banks adopted the technologies at a faster pace. Internet adoption was also associated with improved profitability, higher deposit service charges, increased use of certain deposits, and higher average employee wages.⁵ Research on general technology expenditures found that increased spending in previous years led in later years to greater output—as measured by loans, deposits, and number of branches—as well as to higher bank employment, even after bank size was accounted for.⁶

Research also identifies several external factors linked to technology adoption. Competition, as measured by the adoption decisions of nearby competitors, appeared to influence banks’ decisions to adopt the ATM and mobile banking applications.⁷ Studies documenting a “digital divide” between age groups and between urban and rural areas suggest that certain aspects of a bank’s environment may also play a role in the bank’s adoption decisions to the

extent that those aspects reflect differences in customer demand for technology.

In addition to previous research, the CSBS survey data offer another perspective on factors that may be relevant to the adoption of financial technology. When asked to describe the “most promising opportunities facing your bank regarding new technology,” community banks focused more on their customers than on other potential benefits, such as cost savings and efficiency gains. Phrases referencing customer-facing services, such as “mobile bank,” “remote deposit,” and “online account,” were among those most often used by survey respondents (Chart 6.2). The frequent appearance of the phrases “account open,” “new customer,” and “younger generation” further suggest that some community banks saw customer opportunities that extended beyond the banks’ existing base, and these banks might have been motivated by the potential for growth. The opportunities cited by community banks did not differ significantly among low-, medium-, and high-adopters, as defined above.

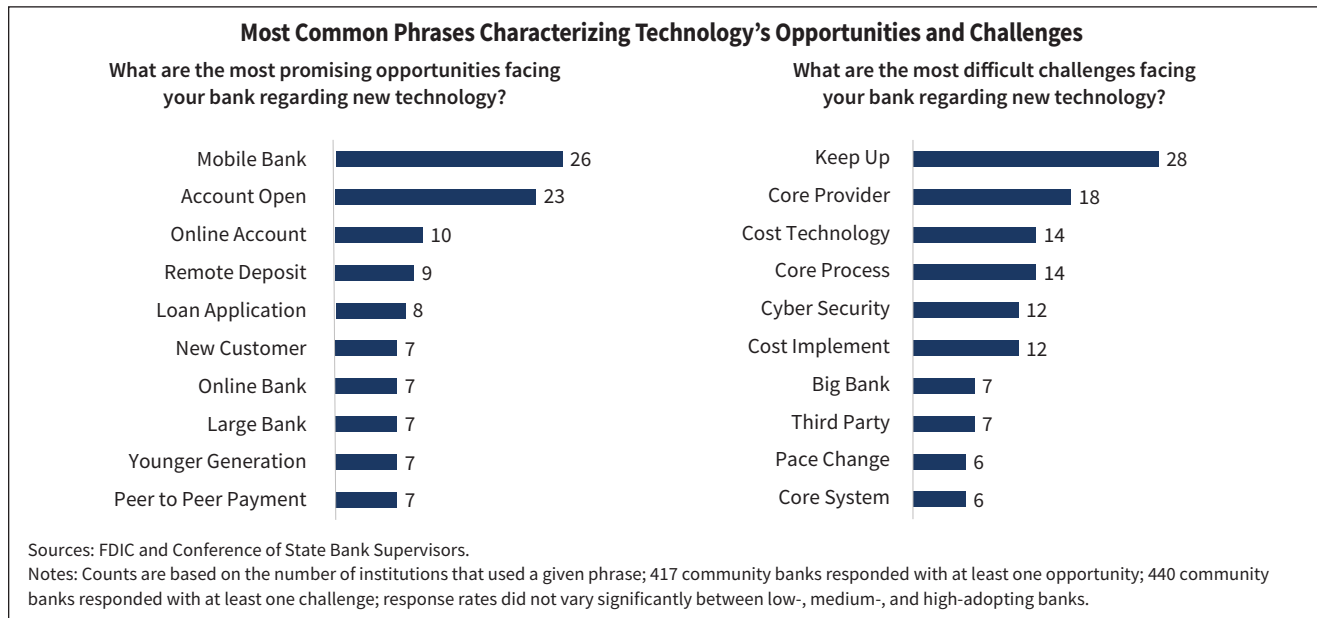
As Chart 6.2 also shows, community banks frequently referenced cost, as well as the phrase “keep up,” to describe the “most difficult challenges” presented by new technology. In some cases, banks used the phrase “keep up” in the context of “keeping up” with competitors—

⁵ Hannan and McDowell (1984); DeYoung, Lang, and Nolle (2007); Sullivan and Wang (2013); Dahl, Meyer, and Wiggins (2017).

⁶ Feng and Wu (2019).

⁷ Dos Santos and Peffers (1998); He (2015).

Chart 6.2



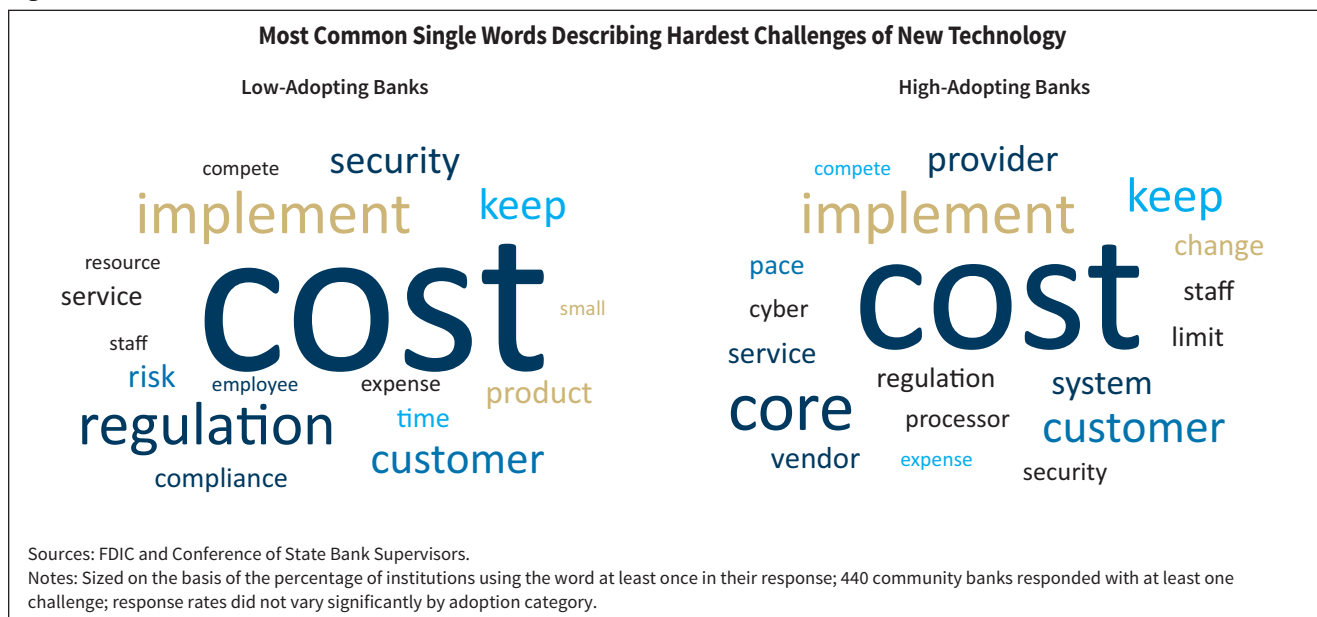
often larger banks. In other cases, community banks referred to the challenge of “keeping up” with the rapid pace of technology development.

mentioned in just under half (48 percent) of the responses provided by low-adopting banks, but also by about 40 percent of high adopters.

References to cost were linked with technology, in general, as well as with the implementation of technology. In addition to appearing in the most-common phrases, cost was also the single word most frequently used by all community banks to describe challenges (Figure 6.1). Use of the word “cost” was highest among low technology adopters, but not by a significant margin: the word was

Unlike their descriptions of opportunities and apart from costs, responses from low- and high-adopting community banks differed with respect to the challenges presented by technology. As Figure 6.1 also shows, low-adopting banks more frequently used words such as “security,” “regulation,” “risk,” and “compliance,” relative to high-adopting banks. High-adopting banks, on the other hand,

Figure 6.1



more often used words such as “core,” “provider,” and “vendor,” which are associated with third-party service providers and, particularly, with core service providers. Across all community banks, 46 (mostly medium- and high-adopting banks) cited their core systems or core service providers when describing the most difficult challenges of new technology. Specifically, when referring to their core systems, community banks noted limited access to desired products and services, integration with current systems, a lack of alternative providers, and speed to implementation.

To further explore how banks that adopted technology differed from those that did not, the chapter now examines the links between technology adoption and factors identified above: a bank’s size and revenues; the relationship between adoption and loans, deposits, growth, and performance; the role played by a bank’s environment; and the role played by leadership’s attitudes and expectations.

Community Banks With More Assets and Revenues Were Greater Technology Adopters

Existing research on the adoption of earlier technologies, as well as the large number of survey responses that mentioned cost, suggest that a bank’s size and resources were major determinants of its decision to adopt or not adopt different technologies.

Bank Size Was the Strongest Indicator of Technology Adoption

Size may be associated with the adoption of technology if larger banks benefit from economies of scale by spreading the fixed costs of adopting technology over a wider customer base. Banks also tend to hire more employees as they grow in size, making it easier for some workers to specialize in technology-specific functions, such as development and maintenance, vendor research and selection, risk management, and compliance. Although many people associate economies of scale with large regional and national banks, other work cited by this study found that community banks generally realize most of the benefits of scale by the time they reach \$600 million in assets.⁸ This makes it plausible to suggest that economies of scale do not just benefit the largest noncommunity banks and that large community banks may have had an advantage over their smaller peers when deciding to adopt technology.

⁸ Jacewitz, Kravitz, and Shoukry (2020).

“Small bank with a small number of customers makes it difficult to justify the cost of new products.”
—(Low-adopting) community-bank president

“The cost of technology is prohibitive as well as the implementation and training of staff to utilize technology to its full potential.”
—(High-adopting) community-bank executive

“Vendors move to[o] slow and for smaller banks we are pushed to back of line.”
—(Medium-adopting) community-bank president

Larger banks may also benefit from greater bargaining power when purchasing technology. For example, a technology service provider may be more willing to customize a product or service for a larger institution because of the additional income and exposure the provider would receive, while offering little to no flexibility to a smaller institution.

On the other hand, bank size may have less of an effect on technology adoption if the cost of adopting a certain technology has declined over time. This decline may be due to recent technologies’ need for less hardware or to the possibility of obtaining cheaper or more widely available technology through service agreements with third parties. For further discussion of how banks obtain technology, see Box 6.2.

On average, high-adopting community banks in the CSBS survey were larger than low- and medium-adopting banks. The average high adopter reported assets that were \$324 million greater than medium adopters and \$535 million greater than low adopters.⁹ (Differences in the median were smaller, but still large, with the median high-adopting bank holding \$228 million more assets than the median medium-adopting bank and \$344 million more assets than the median low-adopting bank.)

Differences in technology adoption were most evident between the largest and smallest community banks. Only 6 percent of community banks with assets less than \$100 million were high adopters, compared with 70 percent

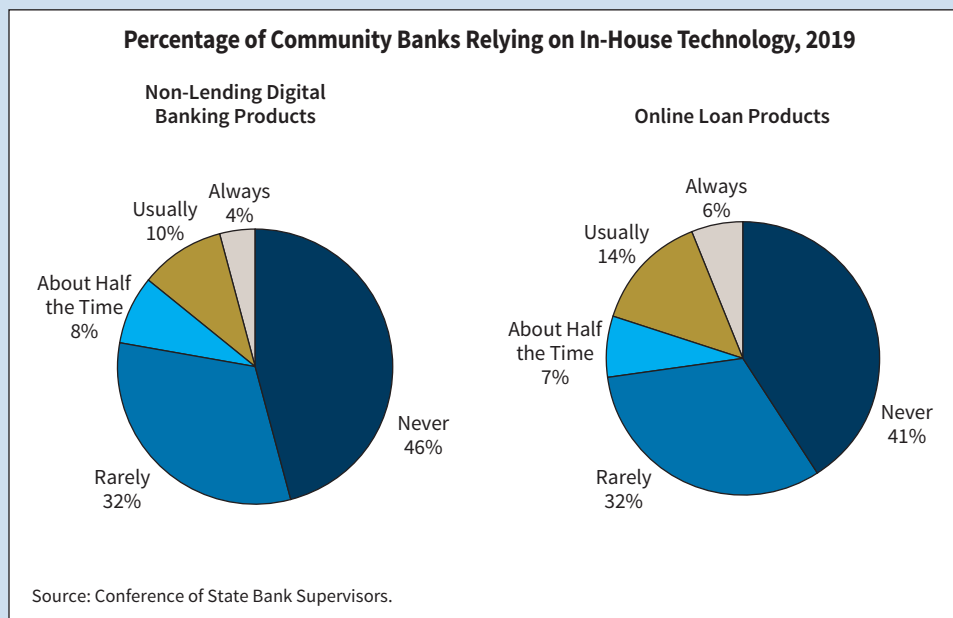
⁹ For some bank factors described in the chapter, including asset size, data that deviated significantly from those of other survey respondents (the reported value was less than or greater than the reported values for 99 percent of responders) were modified to equal the value reported by a community bank at the 1st or 99th percentile. This was done to limit the effect of outlying data without removing it completely.

Box 6.2 Ways That Banks Obtain Technology

Banks obtain new technology in a number of ways. They build it in-house, buy it through merger and acquisition or direct investment, “rent” it by contracting with outside providers including core service providers, or share in it by partnering with other financial and nonfinancial institutions. These pathways are not new, yet much is unknown about the extent to which community banks use each approach.

Data from the CSBS survey indicate that community banks seldom build or buy technology for use in-house. Over three-quarters (78 percent) of community banks participating in the survey responded that they “rarely” or “never” relied on in-house technology for non-lending digital banking products and services (Chart 6.2.1). Of the 218 community banks that offered at least one lending-related technology, almost three-quarters (73 percent) responded that they “rarely” or “never” relied on in-house technology for online loan products. Responses did not vary significantly by adoption category (or, in the case of lending-related technologies, there were too few low-adopting banks for any distinctions to be drawn).

Chart 6.2.1



In contrast, 94 percent of community banks in the CSBS study had relationships with outside providers of digital banking products and services. Among respondents with at least one such relationship, 41 percent of high-adopting community banks sought to expand those relationships, compared with 39 percent of medium-adopting banks and 24 percent of low-adopting banks.

The frequent use of outside technology service providers suggests that further research into these relationships could deepen the understanding of how community banks obtain technology and may reveal additional factors that influence technology adoption. Future work should include the role of core service providers and should attempt to discover whether the challenges expressed by community banks and referenced briefly in this chapter are exceptions, or may be associated with broader differences in technology adoption. As stated by one community-bank executive, “We are currently captive to our core provider and can only move as fast as they are willing to go. We have many initiatives (e.g., debit card tokenization) that are effectively stalled while we wait for [core service provider].”

Future work could also consider whether and how assistance from external sources—for example, shared innovation labs and accelerators, such as the Alloy Labs Alliance and the ICBA ThinkTECH Accelerator—has facilitated community banks’ adoption of technology.

Chart 6.3

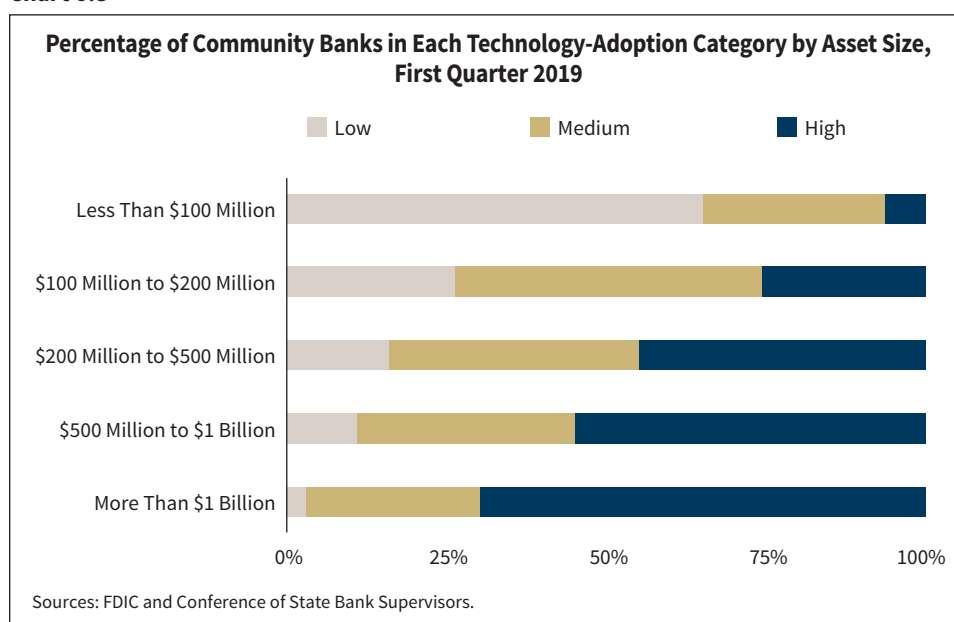


Table 6.2 Adoption Rates for the Largest and Smallest Community Banks

	Less Than \$100 Million	All	More Than \$1 Billion
Online Loan Applications	15.8	37.2	60.6
Online Loan Closing	3.2	4.8	6.1
Mobile Banking	62.1	90.9	100.0
Electronic Bill Payment	65.3	83.2	89.4
Automated Loan Underwriting	4.2	11.6	33.3
Interactive Teller Machines	2.1	10.8	21.2
Remote Deposit Capture	45.3	78.8	98.5

Sources: FDIC and Conference of State Bank Supervisors.

of community banks with assets of more than \$1 billion (Chart 6.3). Similarly, the adoption rate for each of the seven technology-enabled products and services among the smallest community banks was below the comparable rate for all community banks in the survey. The opposite was true for banks with assets of more than \$1 billion (Table 6.2).

Community Banks With Higher Revenue Were Also Greater Technology Adopters

To adopt new technology, banks of all sizes require resources, including staff, knowledge, time, and funding. To the extent that the costs of these resources take up a greater portion of available budgets, community banks may be less willing or less able to adopt technology compared with banks with fewer resource constraints.

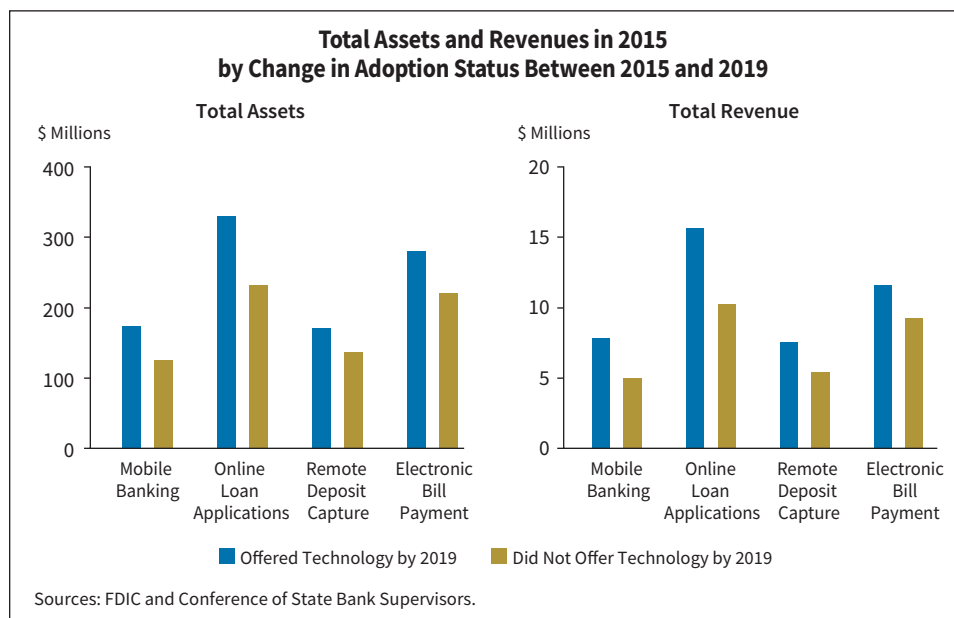
Revenue is one indicator of the ongoing resources that a community bank may have available if it is to invest in new technology. While highly correlated with asset size, revenue may be used as a separate measure to account for banks that earned higher yields on their assets or substantial fee income, which banks would be able to direct toward technology. When taken as a share of assets, total revenue was, on average, 0.3 percentage points greater for high-adopting banks than for low-adopting banks (for a discussion of net income, see section below on performance). When high-adopting banks with between \$100 million and \$200 million in total assets are compared with low-adopting banks of the same size, the high-adopting banks earned 16 percent more revenue (in dollars) than low-adopting banks.¹⁰

“Our budget will never compete with larger banks’ budgets.”
 —(Medium-adopting) community-bank executive

“Small banks do not have the resources to implement and manage new and upcoming technologies. We must wait until the products have been implemented by others and proven to be acceptable from a cost and risk standpoint.”
 —(Low-adopting) community-bank president

¹⁰ There were roughly equal numbers of low-adopting and high-adopting community banks with between \$100 million and \$200 million in total assets.

Chart 6.4



Bank Size and Resources May Have Influenced Technology Adoption, or Been Influenced by It, or Both

Of the factors examined in this chapter, size and resources—as measured by assets and revenues—had the greatest ties to technology adoption. This naturally raises the question of whether and how much these factors predated banks’ adoption of technology or whether they arose afterward. For example, a larger bank may have been more likely to adopt technology because of the lower marginal costs associated with economies of scale. It is also possible that the bank used technology to expand its offerings and enter into new markets, leading to increased size and revenues through growth.

This question is hard to answer with the data available, yet there is at least some evidence that differences in asset size and revenues predated, and thus potentially influenced, community banks’ technology adoption decisions. As mentioned above, CSBS has conducted a survey in each year since 2015. Although the same banks did not participate in each survey, some overlap existed between years. Chart 6.4 compares two groups of community banks that participated in either the 2015 or 2016 survey and reported that their bank did not offer a particular technology product or service at that time. When the same banks were surveyed again in 2018 or 2019, the first group (indicated by the blue bars in Chart 6.4) reported a change in their adoption status (i.e., the bank offered the technology),

while the second group (gold bars) reported no change (i.e., the bank did not offer the technology.)¹¹ For the four technologies included in the survey every year, banks that changed their adoption status and began to offer the technology had, on average, higher assets and higher revenue in 2015 (before adoption).

As discussed in the next section, compared with other community banks in the survey, the 2019 cohort of low-adopting banks has also experienced slower asset growth in each year from 2015 to 2018. However, without additional data, it is unclear whether these differences existed before technology adoption, or whether the adoption of technology increased asset growth, or both.

Other Bank Characteristics Were Also Associated With Technology Adoption

While community banks that adopted technology were most distinguishable by their larger size and higher revenues, other characteristics identified in the research and survey responses were also associated with technology adoption.

¹¹ Of community banks that reported their adoption status in 2015 or 2016 and again in 2018 or 2019, 78 banks did not offer electronic bill payment in the earlier period, 96 did not offer mobile banking, 114 did not offer remote deposit capture, and 235 did not offer online loan applications. By 2019, 60 had adopted electronic bill payment (18 had not), 70 had adopted mobile banking (26 had not), 64 had adopted remote deposit capture (50 had not), and 65 had adopted online loan applications (170 had not).

“[Most promising opportunity is to] expand commercial deposit and commercial loan growth.”
 - (Low-adopting) community-bank president

“Bank is at historically high loan volumes and historically high loan commitments. New technology can help overhead from not increasing too much.”
 - (Medium-adopting) community-bank executive

Total Loans Mattered More Than Loan Type

Loans constitute about two-thirds of a typical community bank’s assets. Technology offers an opportunity to build on and improve this critical function by increasing the speed and convenience of the application process and producing faster underwriting decisions. Community banks with larger loan books may find these benefits more attractive, compared with their costs, than banks with fewer loans. Technology may also allow banks to increase their lending through new and expanded products and entry into new markets. In both cases, we would expect high-adopting

community banks to report higher loans to assets than low-adopting banks.

As expected, among community banks in the CSBS survey, technology adoption was associated with higher shares of loans to assets. Chart 6.5 shows that high-adopting banks held, on average, 10 percent more loans as a share of assets than did low-adopting banks. A higher proportion of loans to assets was not associated with any single technology. Comparing the individual offerings among all community banks in the survey, one sees that for each of the lending-related technologies—online loan applications, online loan closure, and automated loan underwriting—banks that offered a product or service (indicated by the light blue bars in Chart 6.5) had a higher share of loans to assets than those that did not (gold bars).

As also shown in Chart 6.5, high-adopting banks held a greater percentage of their assets in residential loans and C&I loans, and a lesser percentage of their assets in consumer loans, than did low- and medium-adopting

Chart 6.5

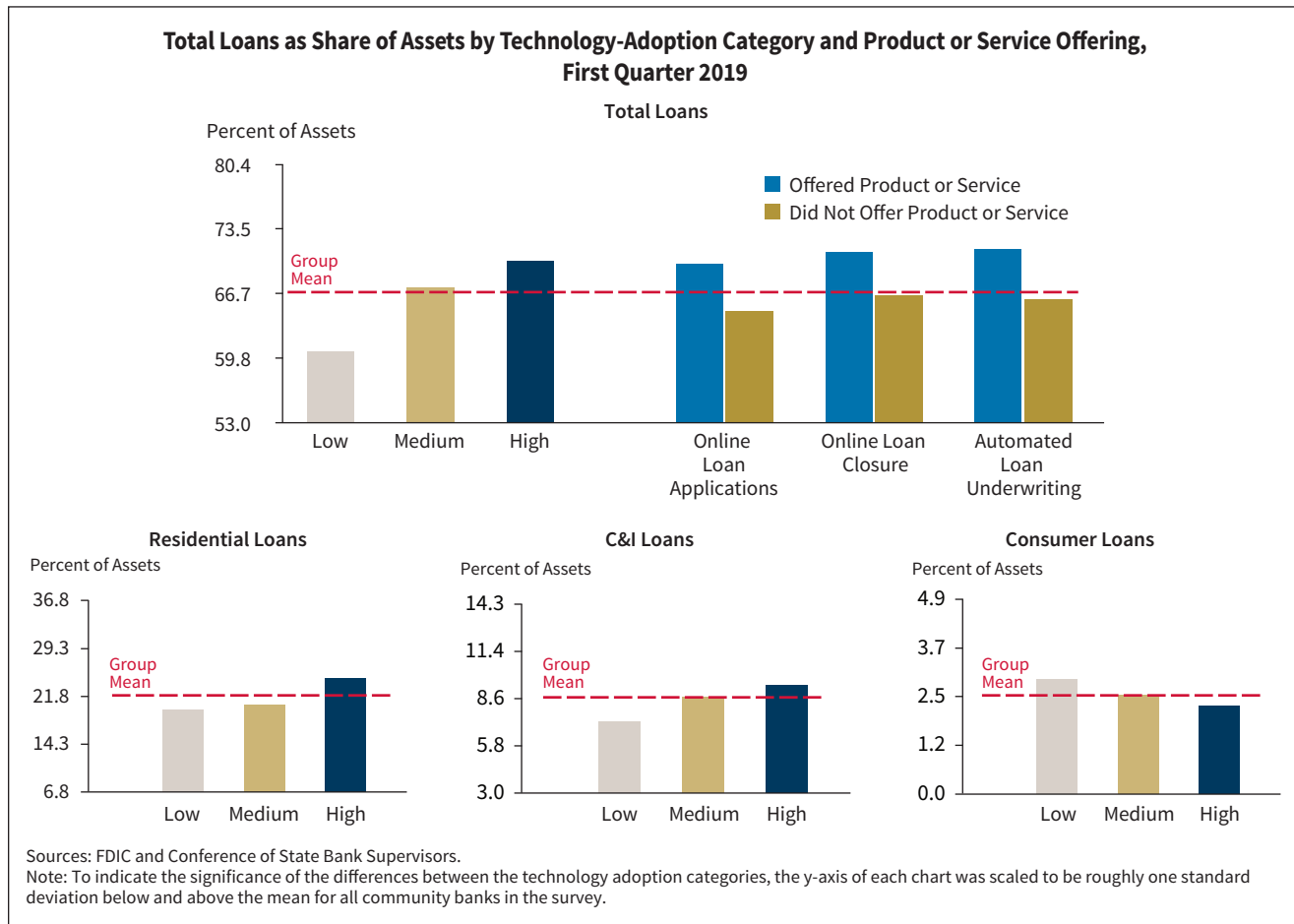
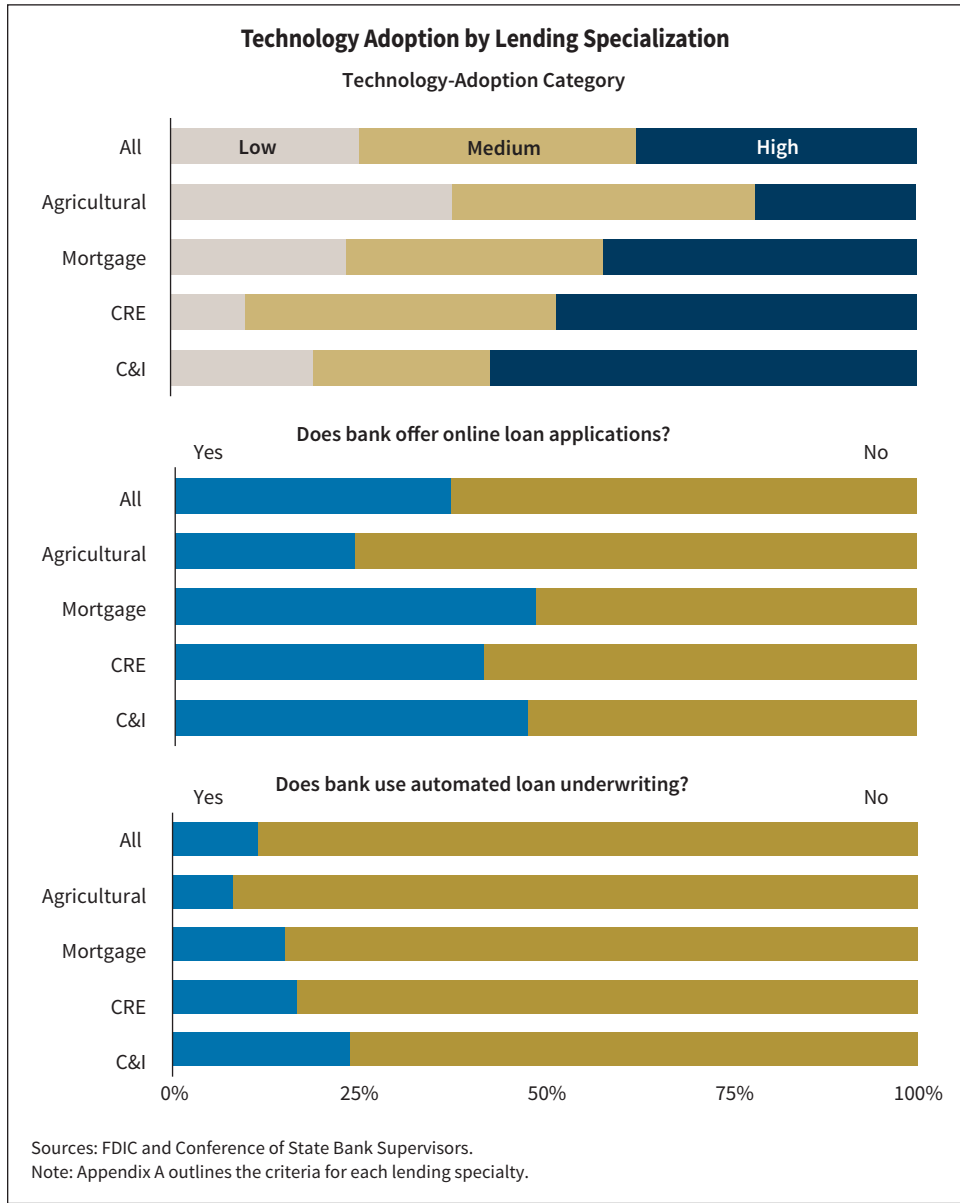


Chart 6.6

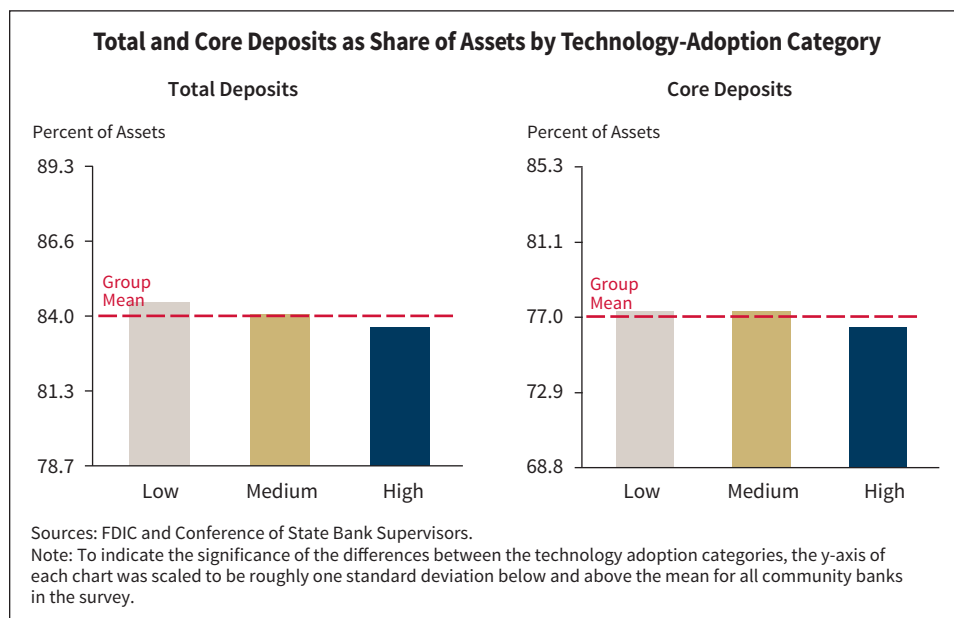


banks.¹² The differences between low- and high-adopting banks—0.7 percent of assets for consumer loans, 2.2 percent for C&I loans, and 4.9 percent for residential loans—were not as large as the difference mentioned above for total loans to assets. Nonetheless, these findings suggest possible dissimilarities in the benefits, costs, or availability of technology between the three loan types.

Another way to examine whether technology adoption varied by lending type is to compare community banks that specialized in certain types of lending. High-adopting banks made up the greatest percentage of C&I specialists, relative to the other lending specializations (Chart 6.6). These banks were also more likely to have adopted online loan applications and automated loan underwriting, compared with all community banks. If one assumes that community-bank business lending typically involves a more hands-on process, as suggested in Chapter 4, these findings may be unexpected. However, these results may reflect the use of technology in *parts* of the lending process (since the portion of the application process that is online or the degree to which underwriting is automated

¹² Residential mortgage lending consists of loans secured by 1–4 family or multifamily (5 or more) residential properties. Consumer loans consist of loans to individuals for household, family, and other personal expenditures—for example, credit card loans, student loans, and automobile loans.

Chart 6.7



was not specified by survey respondents). Or the results may also reflect increased competition from nonbanks, as indicated by a 2020 study that found small businesses were 12 percentage points more likely to receive financing through a fintech or online lender in 2018 than in 2016, with a nearly equal decline in the likelihood of borrowing from a bank lender.¹³

In contrast, high-adopting banks were least represented among agricultural specialists. Such a result is not surprising, given that agricultural specialists tend to be smaller and therefore (as previously indicated) less likely to adopt technology. Agricultural lending may also be more specialized, making automation and online processes less effective or harder to implement.

Technology Was Not Associated With Deposits

Community banks fund most of their assets with deposits, and banks in the CSBS survey were no exception: in first quarter 2019, on average, 84 percent of their assets were funded with deposits. Given the important role of deposit funding, we might expect technology, particularly technology that enhances the functionality of deposit accounts, to be more prevalent in institutions with larger ratios of deposits to assets. For community banks in the CSBS survey, however, deposits

¹³ The study uses the terms “fintech lender” and “online lender” interchangeably to refer to any nonbank online lender, as reported in the Federal Reserve’s Small Business Credit Survey. Barkley and Schweitzer (2020).

as a share of assets did not vary widely by technology-adoption category (Chart 6.7). For low-adopting banks, deposits as a share of assets was less than a percentage point higher relative to medium- and high-adopting banks. Core deposits, which make up the bulk of community-bank deposits, were slightly favored by low-adopting and medium-adopting banks relative to high-adopting banks; when measured as a share of deposits, however, core deposits varied by less than one-half of 1 percentage point between the technology adoption categories.¹⁴ Even for the individual product and service offerings, results were mixed. Shares of total deposits and core deposits were higher for community banks that adopted mobile banking and electronic bill payment but were lower for banks that adopted remote deposit capture and ITMs.

Low-Adopting Banks Generally Had Slower Growth in Assets and Deposits

As mentioned above, community banks frequently cited customers and customer growth as promising opportunities that could follow from the adoption of technology. Therefore, we might expect assets and deposits to grow faster for banks that adopted technology.

¹⁴ Core deposits were calculated according to the definition in the Uniform Bank Performance Report—i.e., as the sum of all transaction accounts, nontransaction money-market deposit accounts (MMDAs), nontransaction other savings deposits (excluding MMDAs), and nontransaction time deposits of \$250,000 and less, minus fully insured brokered deposits of \$250,000 and less.

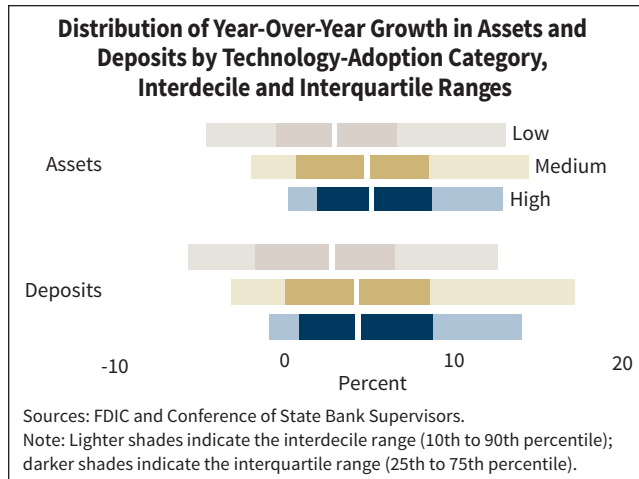
“We have a lot of room for growth and improvement with new technology.”

—(High-adopting) community-bank executive

“[Most promising opportunity regarding new technology is] [m]arket opportunity to increase market share by expanding banking services [and] by utilizing ITMs to control cost of doing so.”

—(High-adopting) community-bank president

Chart 6.8



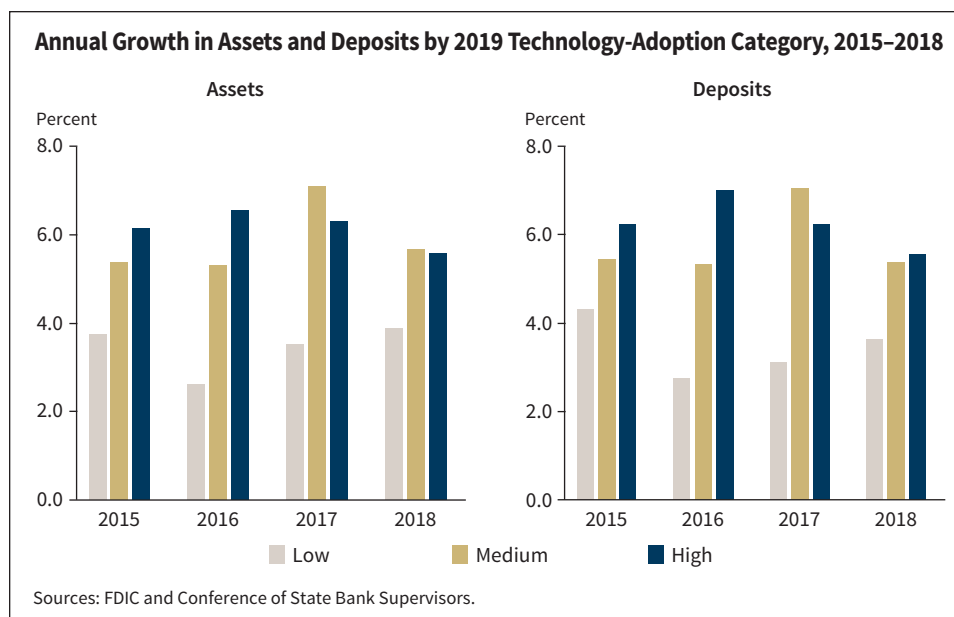
Among community banks participating in the CSBS study, high-adopting banks experienced higher average growth in both assets and deposits relative to medium- and low-adopting banks. For high-adopting banks, asset growth from the first quarter of 2018 to the first quarter of 2019 was 6.3 percent, on average, compared with 6.1 percent for medium-adopting banks and 4.4 percent for

low-adopting banks. Over the same four quarter period, deposits in high-adopting banks grew by an average of 6.1 percent, slightly more than the average for medium-adopting banks (5.9 percent) and significantly more than the 3.4 percent growth experienced by low-adopting banks.

The difference between low adopters and high adopters was most pronounced at the lower ends of the growth distribution (Chart 6.8). With respect to assets, high-adopting banks had significantly higher growth at the 10th and 25th percentiles, growing 0.2 percent and 1.9 percent, respectively, compared with -4.7 percent and -0.5 percent for low-adopting banks. Similarly, for deposits, high-adopting banks at the 10th and 25th percentiles grew by -0.9 percent and 0.8 percent, respectively, which was much higher than the -5.7 percent and -1.8 percent growth experienced by low-adopting banks.

As Chart 6.9 shows, the difference in growth between low- and high-adopting banks did not appear transitory. From 2015 to 2018 low-adopting banks, as defined in 2019, grew their assets between 1.7 and 3.9 percentage points slower

Chart 6.9



than high-adopting banks. For deposits, the difference in year-over-year growth between the two groups ranged between 1.9 percent and 4.3 percent over the same period. There was no consistent pattern in the difference in asset and deposit growth between medium- and high-adopting banks from 2015 to 2018. Although growth during 2015 and 2016 favored high-adopting banks, medium-adopting banks outpaced high-adopting banks in 2017 for both assets and deposits and in 2018 for assets.

High-Adopting Community Banks Outperformed Other Banks in the Survey, but the Reasons Were Unclear

Performance may be associated with technology adoption to the extent that it indicates a greater or lesser capacity for the bank to invest in technology or if banks that adopt technology become more efficient or more adept at marketing or pricing products and services. Table 6.3 shows that high-adopting community banks in the CSBS survey were more likely to be profitable and experience earnings gains in 2018, relative to low- and medium-adopting banks. High adopters earned a pre-tax return on average assets that was 21 basis points greater than the return of low-adopting banks, on average, with 99.5 percent of high adopters generating positive net

“Utilizing new technologies also helps to improve productivity and efficiencies, which are necessary in order to remain profitable and competitive.”

—(Low-adopting) community-bank president

“We are excited to look into the AI platforms and see how this can help our bank’s profits and reduce our salary expenses.”

—(Low-adopting) community-bank president

income, compared with 95.4 percent for low adopters. High adopters reported annual growth in net income that was 7.7 percentage points higher than the comparable reported growth of low adopters, and nearly 8 percent more high-adopting banks increased their earnings from the previous year. Differences between medium- and high-adopting banks followed a similar pattern but were smaller in magnitude. Compared with high adopters, 0.5 percent fewer medium-adopting banks were profitable and 1.3 percent fewer experienced earnings gains in 2018.

Comparing the components of return on assets, it appeared that noninterest income was mainly responsible for the higher returns experienced by high-adopting banks. In

Table 6.3 Average Performance Measures by Technology-Adoption Category, 2018

	All	Low	Medium	High
Net Income (Pretax), 2018:				
Percent With Positive Net Income (Profitable)	98.3	95.4	99.0	99.5
Year-Over-Year Growth, Percent	22.1	19.3	19.0	27.0
Percent of Institutions With Earnings Gains	74.9	69.5	76.0	77.3
Percent of Average Assets	1.23	1.09	1.27	1.30
Components of Return on Assets (Percent of Average Assets)				
Interest Income	4.13	4.07	4.20	4.09
Interest Expense	0.57	0.56	0.58	0.56
Noninterest Income	0.68	0.54	0.62	0.83
Service Charges on Deposit Accounts	0.18	0.18	0.20	0.16
Noninterest Expense	2.93	2.91	2.86	3.02
Expenses for Salaries and Benefits	1.69	1.62	1.66	1.76
Cost of Earning Assets (bp)	62	61	63	61
Net Interest Margin (bp)	389	382	396	388
Average Cost of Interest-Bearing Deposits (bp)	74	75	76	72
Efficiency Ratio	68.3	69.8	67.4	68.1

Sources: FDIC and Conference of State Bank Supervisors.

Notes: Basis point (bp) = 1/100th of 1 percent; efficiency ratio is equal to noninterest expense as a share of operating income.

2018, noninterest income as a percentage of average assets was 29 basis points higher for high-adopting banks than for low-adopting banks and 21 basis points higher than for medium-adopting banks. This difference, however, was not associated with higher service charges on deposit accounts, as earlier research on transactional websites had suggested, and instead was attributable mainly to “other noninterest income.”

For high-adopting banks compared with other banks in the survey, the higher return associated with noninterest income was partially offset by a higher ratio of noninterest expense to average assets. The difference in noninterest expense largely arose because of a 10 to 14 basis point differential in expenses for salaries and employee benefits. Higher staff costs for high-adopting banks contradicts the argument that technology—specifically, automation—reduces staff time devoted to manual processes but coincides with the theory that banks use technology as a complement to, rather than a substitute for, human capital. It is also possible that more specialized and potentially more expensive expertise was needed to adopt technology, resulting in higher costs for salaries and benefits for high-adopting banks relative to low- and medium-adopting banks.

There were minimal differences in interest income and interest expense between the adoption categories. Similarly, technology adoption did not appear to bear any relationship to cost of earning assets, net interest margin, average cost of interest-bearing deposits, or efficiency ratio. This may be because the technologies included in the survey did not translate to differences in these measures, or it may be because any differences have not yet materialized. As one community-bank president said, “In the short term, it [technology] does not improve the efficiency ratio, but in the long term the bank may be rewarded by the retention of younger customers and the future business opportunities they may provide.”

Environmental Factors Were Linked to Technology Adoption

The environment a community bank operates in can affect customer demand, the ability to hire employees, and current and future resources, all of which may play a role in a bank’s decision of whether to adopt technology. On the other hand, with the power to connect banks and customers virtually, the concept of “environment” as

“Being in a more rural area, customers don’t require the newest technology as soon as other areas and there is less local competition.”

—(Low-adopting) community-bank president

defined by a bank’s physical location may no longer apply in the same manner as it has in the past.¹⁵

Differences between urban and rural consumers in their demands and capabilities may affect a community bank’s decision to adopt or not adopt technology. For example, a “digital divide” between rural and urban Americans has been documented for many years, with 2019 data from the National Telecommunications and Information Administration showing a 6 percentage point differential between urban and rural areas in the share of people using the internet at home. This difference increased to 8 percentage points for smartphone use.¹⁶ Survey data collected in 2017 by the Pew Research Center found that rural adults were less likely to have multiple devices with internet access, less likely to use the internet on a daily basis, and more likely to never go online, compared with suburban and urban counterparts.¹⁷

Table 6.4 shows that among community banks in the CSBS survey, the probability of being a low-technology adopter increased from 28 percent to 39 percent if the bank was located in a rural area (defined in the data as “other area”). Conversely, the probability of being a low-technology adopter decreased from 51 percent to 43 percent if the bank was located in an urban area (defined in the data as “metropolitan area”). The higher share of low adopters among rural community banks persisted even after differences in asset size were accounted for. The opposite pattern was true for the likelihood that a community bank was a high adopter, although in this case, for banks of similar asset size, location in a rural or urban area had less of an effect.

Community banks in areas with low population or economic growth may be less likely to invest in technology if those banks are concerned that slow growth will limit their future revenue or customer base. Similarly,

¹⁵ In this chapter, unless otherwise specified, environmental factors were measured on the basis of the location of a community bank’s main office.

¹⁶ National Telecommunications and Information Administration (2020).

¹⁷ Perrin (2019).

Table 6.4 Characteristics of Bank Environment by Technology-Adoption Category

	All Banks in Survey	Low-Adopting Banks	Medium-Adopting Banks	High-Adopting Banks
Main Office Location (Percent in Each Category):				
Metropolitan Area (Urban Area)	51.1	42.7	48.7	59.0
Micropolitan Area	21.0	18.3	20.2	23.6
Other Area (Rural Area)	27.9	38.9	31.1	17.4
Population Growth:				
Cumulative Annual Growth From 2010 to 2018, Percent	0.22	0.13	0.19	0.31
Located in a Depopulating County (2010 to 2018)	42.2	51.1	40.4	37.9
Median Age of Local Population (2018)				
In Years	39.9	40.8	39.3	39.9
Located in County in the Highest (Oldest) Quartile	25.4	36.6	18.1	25.1
Located in County in the Lowest (Youngest) Quartile	22.7	16.8	26.4	23.1
Cumulative Annual GDP Growth From 2010 to 2018 (Percent)	3.09	2.85	3.04	3.31
“Greatest Single Challenge” Facing Bank is Business Conditions	7.1	9.7	5.8	6.7
Average Competitors Within 10 Miles (Percent in Each Category):				
Less Than 2	8.1	16.8	7.8	2.6
2 to 5	24.5	32.1	26.4	17.5
5 to 10	28.6	29.8	25.4	30.9
10 to 25	29.9	16.0	32.1	37.1
More Than 25	8.9	5.3	8.3	11.9
Share of Deposits Within 10 Miles (Percent in Each Category):				
Less Than 10 Percent	30.2	24.4	32.8	31.4
10 Percent to 33 Percent	44.7	37.4	43.8	50.5
More Than 33 Percent	25.1	38.2	23.4	18.0
“Greatest Single Challenge” Facing Bank is Competition	14.9	12.4	12.7	19.0

Sources: FDIC, Conference of State Bank Supervisors, and Bureau of Economic Analysis.

Note: Counties in the youngest 25 percent are those where the median age is 36.6 years or below; counties in the oldest 25 percent are where the median age is 42.5 years or above (see Chapter 3 in this study).

banks may be less likely to prioritize technology if they are located near fewer customers who demand or use it—for example, areas with a higher median age.¹⁸ On the other hand, such banks may also be motivated to adopt technology to expand into growing markets or to attract and retain younger customers, as indicated by multiple community banks in the CSBS survey.

On average, high-adopting community banks in the CSBS survey were located in counties with higher economic growth, as measured by the cumulative annual growth rate (CAGR) for GDP. Between 2010 and

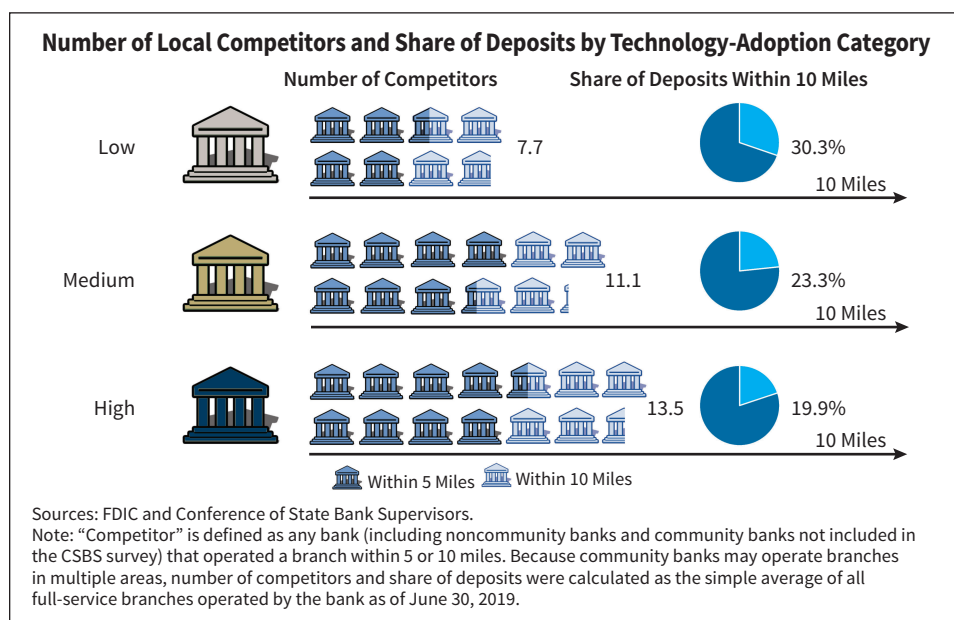
¹⁸ Vogels (2019). Another online survey conducted in 2019 found that 62 percent of those ages 18 to 29 banked using a mobile app compared with 22 percent of those ages 55 to 64 and 7 percent of those 65 and older. American Bankers Association (2019).

2018 the average county-level CAGR for high-adopting banks was 3.3 percent, compared with 3.0 percent for medium-adopting banks and 2.9 percent for low-adopting banks (Table 6.4). When banks of similar asset size were compared, the difference between high- and low-adopting banks narrowed slightly but did not

“Mobile deposit has helped retain some of our younger customers as they go off to the big cities to college.”
—(Low-adopting) community-bank president

“Another challenge is to persuade the senior generations (baby boomers my age and older) to accept and utilize the new technology.”
—(Low-adopting) community-bank president

Chart 6.10



disappear. Low-adopting banks were also more likely to cite “business conditions” as the greatest single challenge facing their bank. The pattern did not hold for all adoption categories, however, since high-adopting banks were more likely to cite this challenge than medium-adopting banks.

Other local factors, such as median age and population growth, did not have a strong tie to technology adoption. From 2010 to 2018, while low-adopting banks were more often located in counties with negative population growth (51 percent, as opposed to 40 percent for medium-adopting banks and 38 percent for high-adopting banks) and with a slower average CAGR, these differences disappeared after asset size was accounted for. Similarly, when banks of similar size were compared, differences in the average median age and the share of banks located in the youngest and oldest counties by quartile declined in magnitude.

Responses to the CSBS survey indicate that competition was a consideration for community banks, with most respondents viewing banks located within their market as their greatest source of competition.¹⁹ Therefore, we might expect the level of competition within a bank’s

¹⁹ Over 15 percent of CSBS survey respondents (including those not examined in this chapter) selected competition as the “single greatest challenge” facing their bank; only core deposit growth (22 percent) and regulation (16 percent) registered more responses. For all but two products and services (wealth management/retirement services and payment services), over 75 percent of respondents indicated that their greatest source of competition came from institutions with a headquarters, a branch, or a satellite office in their market.

“We invest in and use technology because the market place requires us to do so.”

—(High-adopting) community-bank executive

“New technologies of every kind offer our bank a better opportunity to stay competitive with the large regional banks and the money-center banks.”

—(Medium-adopting) community-bank executive

market—as measured by the number of banks (including noncommunity banks) operating within a certain distance and by the share of local deposits held by the bank—to play a role in technology adoption. Community banks with a larger share of local deposits or that operate in close proximity to fewer banks would likely feel less pressure to adopt new technology, compared with banks that have a smaller share of deposits and a greater number of local competitors.

Using data on deposits and location by branch from the FDIC’s Summary of Deposits survey, low-adopting banks tended to operate in markets with fewer average competitors per bank branch. (For this chapter, a community bank’s market was the five- and ten-mile radius surrounding each of the bank’s branches.) Using this measure, low-adopting banks faced an average of 7.7 competitors, compared with 11.1 competitors for medium-adopting banks and 13.5 competitors for high-adopting banks (Chart 6.10). Low-adopting banks also operated in markets where they held 10.4 percent

more deposits as a share of all the deposits held by banks within ten miles, compared with high-adopting banks. This difference decreased only marginally after bank size was accounted for.

Attitudes Toward Technology and Expectations About Profitability and Expansion Played a Role in Adoption Decisions

Not surprisingly, technology adoption differed depending on the importance a bank attributed to technology. For example, 81 percent of high-adopting banks responded that technology adoption was either “important” or “very important,” compared with 71 percent of medium-adopting banks and 56 percent of low-adopting banks. With respect to technology leadership, 32 percent of high-adopting banks felt that it was “important” or “very important” to be a leader in new or emerging technologies, compared with 28 percent for medium-adopting banks and 14 percent for low-adopting banks. The fact that most banks, including high adopters, stated that technology adoption—but not technology leadership—was important aligns with the analysis above indicating that community banks were generally focused on “keeping up” rather than leading in technology. The findings also suggest that technology adoption goes beyond a bank’s characteristics

“Community banks have the opportunity to show and prove to customers that their technology can rival that of much larger banks.”

—(Medium-adopting) community-bank executive

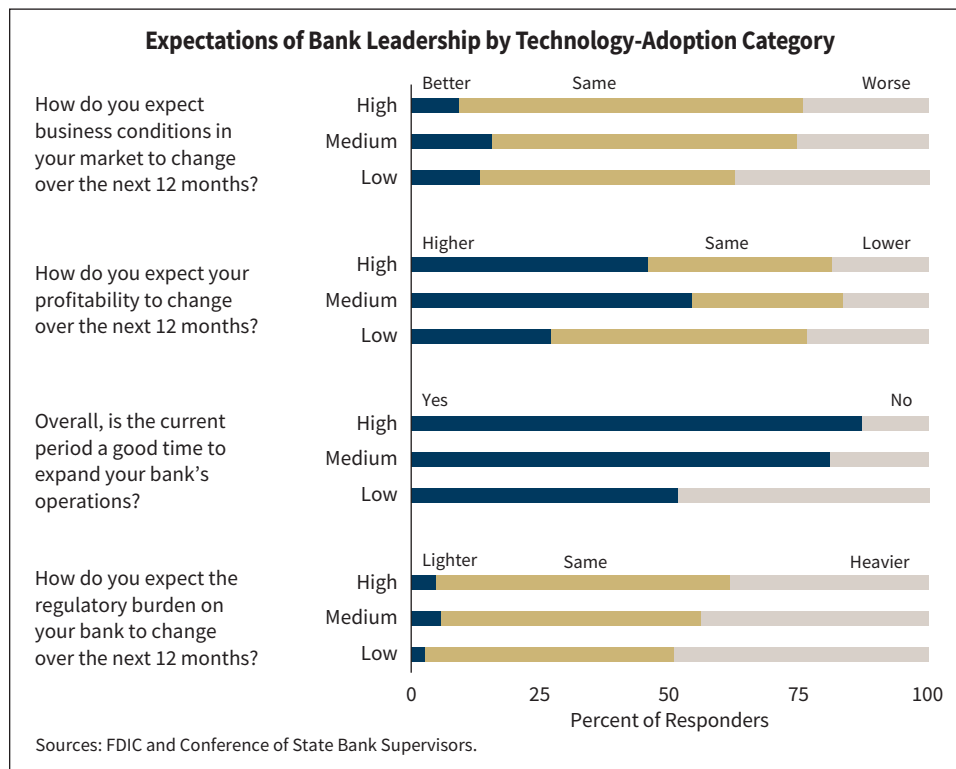
“Community banks survive on quality, personal customer service, not technology advancements.”

—(Low-adopting) community-bank president

and its environment to include, in addition, the bank’s attitudes toward technology.

Further, technology adoption varied by attitudes and expectations not directly related to technology. Chart 6.11 displays responses to four questions about a bank’s expectations for business conditions, profitability, and regulatory burden over the next 12 months, as well as the bank’s overall outlook for expansion. In each case, low-adopting banks tended to have more-pessimistic views than did medium- and high-adopting banks. The largest differences appeared in expectations for future profitability and outlook for expansion. The percentage of low adopters that believed profitability would be higher over the next 12 months trailed the percentage of high-

Chart 6.11



adopting banks by nearly 19 percentage points and trailed medium-adopters by 27 percentage points. Just over half of low-adopting banks believed that the current period (at that time, spring 2019) was a good time to expand bank operations, compared with 81 percent of medium-adopting banks and 87 percent of high-adopting banks.

Future Research Will Yield Greater Insights Into Technology Adoption

To explore how banks that adopted technology differed from those that did not, this chapter has examined several characteristics of community banks, their environment, and the attitudes and expectations of their leadership. For respondents to the CSBS survey, size and revenue were the main factors differentiating low adopters, medium adopters, and high adopters among community banks. Other factors, including a bank's expectations and attitudes toward technology, its ratio of loans to assets, and its competitive environment, were also relevant, but not as much as size and revenue.

In the future, the FDIC plans to undertake additional research to overcome some of the limitations of this chapter. First, the measure used to differentiate “low,” “medium,” and “high” adopting banks cannot account for the length of time that a community bank offered or used a particular technology or for the quality and functionality of the technology. In the future, such information could be collected and analyzed to determine whether specific components or uses of technology were associated with the factors studied here and whether these associations varied by early and late adopters.

Second, while these findings include some evidence of directional effects, data collected over a longer period may help us distinguish between two types of effect: the effects of different factors on a bank's decision to adopt technology, and the effects of adopting technology on those factors. In addition, ongoing data collection will

help us not only identify changes in adoption patterns over time but also incorporate new technologies as they become available. The former is particularly relevant given the short- and long-term changes in technology use and adoption that may arise from the COVID-19 pandemic (see Box 6.3).

Third, further research may explore whether the factors explored in this chapter, as well as others, may affect the decisions of different subsets of community banks to adopt or not adopt technology. Such work may also help inform policy discussions on other topics—for example, deposit flight from depopulating rural areas. A comparison of the technology profiles of community banks located in rural areas with a declining population could help determine whether certain technologies helped some banks in those areas retain customers or attract out-of-market deposits.

Finally, future research should incorporate data from all community banks to the greatest extent possible. While community banks participating in the CSBS survey generally reflected the wider population, any differences could prevent the broader application of findings reported in this chapter. For example, the CSBS survey did not include responses from community banks with national charters or from banks in every state. Such banks may approach their technology adoption decisions differently; therefore, it would benefit future researchers if these differences were eliminated as much as possible.

As the primary federal regulator for most community banks, the FDIC encourages further research into factors that may have influenced, or may have been influenced by, a community bank's technology adoption decisions. The FDIC also encourages further research in the use of technology in community banks in general. Ongoing research and data collection is needed to keep pace with rapidly evolving technology and to better understand the benefits and risks of community banking in a digital age.

Box 6.3 Technology Adoption and the COVID-19 Pandemic

The COVID-19 pandemic has given rise to a defining change for community banks: a broader use of technology, both at present and for the future. The pandemic has resulted in branch closures, stay-at-home orders, and a general desire to limit direct contact, all of which has increased the use of computers, mobile phones, and other smart devices to complete financial services transactions. To meet growing demand, community banks have used both direct investment and contracts with technology service providers and fintechs to accelerate their adoption of technologies that enable such services as remote deposit, online applications, peer-to-peer payments, and electronic signatures.

Some community banks, for example, used technology to help manage the unprecedented volume of loan applications received in response to the Small Business Administration's (SBA) Paycheck Protection Program (PPP).^a Over the span of a few months, community banks provided billions of dollars of needed credit to small and medium-sized enterprises through the program, with 3,843 community banks holding over \$14.8 billion in PPP loans as of June 30, 2020. Arguably, technology facilitated this lending by allowing some community banks to accept applications and supporting documentation online, process applications faster, and submit files for SBA approval.^b As the PPP moves into its next phase, community banks are also seeking the aid of technology to automate loan forgiveness applications.^c

Not all accounts from community bankers and borrowers about using technology to assist with PPP lending were positive, however, nor is it clear that technology increased the use or efficiency of the program. Reports of difficulties connecting with SBA's systems (E-Tran) and last-minute changes to the program, including a ban on robotic data entry systems, suggested a limit to the effectiveness of technology.^d Nonetheless, at least among community banks in the 2019 CSBS survey, those identified in this chapter as high-technology adopters showed greater participation in the program, with PPP loans totaling 6.5 percent of assets, compared with 5.7 percent of assets for medium-adopting banks and 5.0 percent of assets for low-adopting banks. Future research may better identify the extent to which technology facilitated PPP lending as well as other credit during the pandemic.

The degree to which banks continue after the pandemic to rely on technology investments and partnerships made during the pandemic remains unknown; however, it seems unlikely that customers' use of technology will return to pre-pandemic levels even after branches and the economy resume normal operations. In a PriceWaterhouseCoopers (PwC) survey of 6,000 U.S. bank customers conducted in May and June 2020, 24 percent stated they were less likely to use their bank's branch offices. In addition, following months of remote work, banks (like many other businesses) may consider permanent changes to workspaces, which could have long-term effects on branch structure and operating expenses.

It is also possible that because of the pandemic, technology adoption by community banks will decrease. Banks that experience financial hardship may have reduced ability and desire to invest in new technology, a development suggested by the findings of this chapter associating revenues and local economic growth with technology adoption. And post-pandemic, some community banks may experience less of a decline to branch traffic, a development suggested by the number of respondents to the PwC survey who indicated they were likely to continue using branch offices, including for services that can be done remotely.

^a As discussed in previous chapters, the PPP provided a federal guarantee for low-interest forgivable loans made to eligible businesses by bank and nonbank lenders.

^b Groenfeldt (2020).

^c Cross (2020).

^d Price (2020).