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Users as service innovators: The case of banking services

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ABSTRACT

Many services can be self-provided. An individual user or a user firm can, for example, choose to do its own accounting – choose to self-provide that service – instead of hiring an accounting firm to provide it. Since users can 'serve themselves' in many cases, it is reasonable to suspect that they can also innovate with respect to the services they self-provide – possibly without the assistance of service providers.

In this paper, we conduct the first quantitative exploration of the importance of services innovation by users, focusing on the field of commercial and retail banking services. We find that 55% of today's computerized commercial banking services were first developed and implemented by non-bank firms for their own use, and 44% of today's computerized retail banking services were first developed and implemented by individual service users rather than by commercial financial service providers. Manual precursors to these services – manual procedures that carried out functions similar to computerized services in our sample – were almost always developed by users as self-services.

Our empirical findings differ significantly from prevalent producer-centered views of service development. We speculate that the patterns we have observed in banking with respect to the major role of users in service development will prove to be quite general. If so, this will be an important matter: on the order of 75% of GDP in advanced economies today is derived from services. We discuss the implications of our findings for research and practice in service development.

1. Introduction and overview

Often, services are thought of as something that involves a producer and a consumer – for example, a taxi can produce transportation service for a passenger. But it is also true that a passenger can drive himself – self-provide a similar transportation service. This possibility is understood in the literature on services. Thus, Vargo and Lusch (2004, p. 2) define services as "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself."

Since users *can* 'serve themselves' in many cases, it seems reasonable to speculate that it is also possible for users to innovate with respect to the services they deliver to themselves. Service users, as we define the term, are *firms or individuals* that expect to benefit from using a service. In contrast, service producers are firms or individuals that expect to benefit from selling a service. A service innovation is therefore user-developed if the developer expects to benefit from use, and producer-developed if the developer expects to benefit from sales.

In this paper, we conduct the first quantitative study of the role of user-innovators in service development. We focus on a sample of financial services offered by banks, a major services category. Financial services represent about 6% of employment and GDP in the US, and about 8% of GDP and 4% of employment in the OECD (U.S. Department of Commerce, 2010; OECD, 2008). For our study, we first identified all important service innovations newly commercialized by retail and commercial banks between 1975 and 2010. We then inquired into the history of user activity prior to the offering of each of these service innovations by banks. A central finding of our study is that users often develop and self-provide important financial services before banks or other types of financial service producers begin to offer them.

Today, essentially all banking services are computerized for reasons of speed, accuracy, and economy. With respect to the sources of innovation in computerized banking services, our central findings are as follows. In 55% of *commercial* banking services in our sample, user firms developed and self-provided computerized versions of the services earlier than banks or other types of service producers offered them. For example, computerized payroll processing was first developed and used in the early 1950s as a

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self-service by J. Lyons and Co, a major baking and catering firm in the UK. Other user firms followed. Banks first offered that service to commercial customers in the 1980s.

In 44% of *retail* banking services in our sample, we found that individual users of retail bank services had developed and self-provided computerized versions of these services before banks or other types of service producers offered them. For example, computerized aggregation of account information across multiple institutions was first implemented by individual "hackers" for their own use in the 1980s (Hemenway and Calishain, 2004). It was first offered by Yodlee, a non-bank commercial producer, in 1999 (Spiotto, 2002). It was first offered by a bank as a commercial service to retail customers in 2006 (Netbanker, 2006).

We also explored the sources of innovation in the case of manual versions of banking services that often preceded computerized offerings. Here, commercial and retail users were almost always the initial developers. With respect to the sources of innovation in manual banking services, our central findings are that 92% of corporate banking services provided in manual form were developed and self-provided by users before being offered by banks. The remaining 8% were developed jointly by users and banks. In the case of retail services, 80% were developed by users, and 20% were jointly developed by retail users and banks.

These empirical findings documenting the major role of users in financial services development differ significantly from prevalent producer-centered views of service development. We will speculate that the patterns we have observed with respect to the major role of users in service development will prove to be quite general. If so, this will be an important matter: on the order of 75% of GDP in advanced economies today is derived from services. An improved understanding of the role of users in the services innovation process will clearly be valuable.

In the sections that follow, we first review relevant literature (Section 2), then explain our research methods (Section 3). In Section 4 we present our findings, and in Section 5 we discuss the implications of these findings and further research possibilities.

2. Literature review

In this literature review, we first review the economic importance of services (Section 2.1). Next, we review literature on process innovation in services (Section 2.2). Finally we briefly review what is known about the locus of innovation in both services and products (Section 2.3).

2.1. The economic importance of services

Collection of uniform governmental statistics on services is enabled by standard lists of activities that are deemed to be services. The North American Industry Classification System (NAICS) and the Statistical Classification of Economic Activities in the European Community (NACE) provide classifications of services under nine high-level categories: Wholesale and retail trade; hotels and restaurants; transport, storage, and communication; financial intermediation; real estate, renting, and business activities; public administration and defense; education; health and social work; other community, social, and personal service activities (UN et al., 2002).

Statistics based upon the definitions noted above indicate that economic activity in modern economies involves services primarily. For example, in 2006 in the US, services in aggregate employed 144.4 million people, representing 78.7% of total employment. Services also contributed 77% of Gross Domestic Product (GDP) in the US economy in 2006. Financial services are a major services category, employing some 5.77 million individuals in the US (about 6% of total private non-farm employment) and generating about 6% of GDP (U.S. Department of Commerce, 2010).

2.2. Users' role in services innovation

In the study to be reported upon here, we quantitatively explore the role of users in development of commercially important service innovations. Recall that "users" are defined as firms or individual consumers that expect to benefit from *using* a product or a service. In contrast, producers expect to benefit from *selling* a product or a service.

Prior literature on user innovation in services has identified examples of service development by users in a few fields. Riggs and von Hippel (1996) reported on user development of novel banking services related to an early form of electronic home banking that utilized a telephone channel between customer and bank. Potential study participants ("lead users") were recruited by an email directed to a sample of convenience – approximately 1300 research and development engineers employed by a telecom firm. These individuals were asked whether they had "... found novel ways to take care of their personal banking service needs via electronic home banking. For example,... written or adapted a home software program to automate a manual procedure, found a novel way to use a service offered by the bank to achieve a purpose other than was originally intended, or devised a novel procedure for paying bills or keeping records." Fifteen individuals responded with return messages that included a brief description of novel home banking services they had self-developed for their own use.

Skiba and Herstatt (2009) explored Internet and newspaper reports and identified 3 examples of commercially important services that had been developed by users for their own use and then commercialized by these same user-innovators. One of these, the pre-commercial history of the service firm Weight Watchers, is illustrative. In brief recapitulation, in 1961 a US housewife named Jean Nidetch was frustrated at encountering repeated failures in her personal efforts to lose weight. As a new approach, she created weekly group meetings with her overweight friends to provide a peer-to-peer support service to augment their previously independent efforts to lose weight. This self-developed and self-provided service proved very effective for the members of her group. In 1963 she incorporated the firm "Weight Watchers" – now a major service producer – to commercialize the service and diffuse it more widely.

Researchers on the topic of services have traditionally conceived of new service development as a producer-centered process similar to traditional producer-centered new product development processes. They also have focused prescriptively on "how service producers should develop new services" rather than on exploring user roles in service innovation histories. In the multistep processes generally prescribed, firms wishing to provide new services – for example, banks and hotel chains – are instructed to study users to discern and deeply understand the users' articulated and unarticulated service-related needs. Then, service developers employed by the producer firm are tasked with creating and testing new services intended to be responsive to the needs identified. Service users are clearly not viewed as potential service creators in these processes (e.g. Shostack, 1981, 1984; Storey and Easingwood, 1995; Johne and Storey, 1998; de Jong and Vermeulen, 2003; Flikkema et al., 2003; Menor and Roth, 2008; Oliveira and Roth, 2011a,b).

Recently, some innovation researchers and process consultants have described processes in which users are viewed as "co-creators" who should be invited in to join service producer personnel to work together on service development (e.g., Lengnick-Hall, 1996; Prahalad and Ramaswamy, 2002, 2004; Moller et al., 2008; Spohrer, 2009; Nambisan and Nambisan, 2008; Payne et al., 2008; Skiba and Herstatt, 2008; Nambisan and Baron, 2009;

Edvardsson et al., 2011). For example, Moller et al. (2008) provide a recipe for managing service co-creation and propose guidelines on how to succeed through collaborative capabilities and culture. In the same line, Prahalad and Ramaswamy (2002) and Payne et al. (2008) propose a framework to suggest how companies can better understand consumers' views, and work with them to co-create innovations. Matthing et al. (2006) and Lüthje (2000) among others, support the potential utility of this approach. They argue that the most effective service users to incorporate in co-creation exercises are 'lead users', and document that lead users are sources of new service ideas with high commercial potential.

2.3. Users' role in product innovation

It seems to us likely that findings with respect to user development of service innovations will be similar in many ways to those documented in the case of user development of product innovations. We therefore briefly review some major findings on users as product innovators.

Quantitative studies of user innovation document that many of the most important and novel products and processes commercialized in a range of fields are developed by users for in-house use. Thus, von Hippel (1988) found that users were the developers of about 80% of the most important scientific instrument innovations, and also the developers of most of the major innovations in semiconductor processing. Pavitt (1984) found that a considerable fraction of invention by British firms was for in-house use. Voss (1985) explored the role of users in developing software and found the circumstances where users lead the development of new applications. Shah (2000) found that the most commercially important equipment innovations in four sporting fields tended to be developed by individual users.

Empirical studies also show that *many* users—from 6% to nearly 40%—engage in developing or modifying products. This has been documented in the case of specific types of industrial products and consumer products, and in large, multi-industry studies of process innovation in Canada and the Netherlands as well (Urban and von Hippel, 1988; Herstatt and von Hippel, 1992; Morrison et al., 2000; Lüthje, 2003, 2004; Franke and von Hippel, 2003; Franke and Shah, 2003; Lüthje et al., 2002; Arundel and Sonntag, 1999; Gault and von Hippel, 2009; de Jong and von Hippel, 2009). When taken together, the findings make it very clear that users are doing a *lot* of product development and product modification in many fields.

Research has also shown that innovation by users tends to be concentrated among 'lead users'. Lead users are a subset of user populations distinguished by two attributes. They are: (1) ahead of the bulk of the market with respect to an important trend and; (2) expect to gain major benefits from solutions to needs they encounter at that leading edge. Because they expect major benefits from a solution they are likely to innovate. Because they are 'at the leading edge', products they develop for their own use often represent commercialization opportunities for producers (von Hippel, 1986; Urban and von Hippel, 1988; Herstatt and von Hippel, 1992; Olson and Bakke, 2001).

The likelihood a user will innovate is affected by the amount of profit expected, as is the case for all types of innovation and innovators (e.g., Schmookler, 1966; Mansfield, 1968; Morrison et al., 2000). The probability that a user will innovate is also positively associated with the amount of resources a potential user-innovator has to invest in an innovation. Given full information availability to all potential investors, the amount of resources possessed by the potential innovator itself should not matter – an attractive opportunity should draw resources from elsewhere if they are not available locally. However, information stickiness results in potential user-innovators having better information on their own need and solution strategy than can be conveyed to outside investors. Therefore, the level of in-house resources available for investment at the discretion of a potential user-innovator matters, and is positively associated with innovation likelihood (Franke et al., 2006).

Information stickiness also causes user and producer innovators to rely more heavily on information they have 'in stock' than upon information they must draw in from external sources. This in turn means that users and producers will tend to develop different *types* of innovations. Users generally have a more accurate and more detailed model of their needs than manufacturers have, while producers have a better model of the solution approach in which they specialize than does the user. As a consequence, users tend to develop innovations that are functionally novel, since these tend to require a great deal of user-generated need information and context of use information for their development. In contrast, manufacturers tend to develop innovations that are improvements on well-known needs and that require a rich understanding of solution information for their development (Riggs and von Hippel, 1994; Ogawa, 1998). Roy (2009) explores how firms that are both lead users and producers of industrial robotics equipment benefit from their easy in-house access to sticky need information. He finds they tend to offer commercial equipment with more advanced features than do commercial robot producers without access to in-house lead users.

3. Research context and methods

For our exploratory empirical study on the sources of major services innovations, we elected to study the origins of major banking services offered by banks and, often, other types of producers to retail and corporate customers. Financial services are major factors in modern economies. As was noted earlier, in aggregate, financial service firms contributed 7.9% of US GDP in 2004, and also were major employers, accounting for 4.5% of total US employment in 2004 (OECD, 2008). Within financial services the specific field we chose to focus on was service innovations in commercial and retail banking. We had no pre-knowledge of innovation patterns that informed this choice. However, we thought it would be helpful both to us and to our readers that many are familiar with banking, and with some of the banking services we discuss.

3.1. Sample identification process and sample

Our sample consists of financial services offered by major US commercial banks at the time of this study, that were first commercially introduced by US banks in the period 1975–2010 (important banking services introduced before this date are identified in Table A1). We elected to focus on this recent period because we expected to find better data on the sources of innovation that were within the memory of banking experts still active in the field. During 1975–2010, both users of banking services and banks were engaged in heavy investment in computerization of their processes and services (The Economist, 2010). We therefore expected to find a large number of computerization-related financial services to have been introduced during this period by services users and/or banks or other types of financial service producers.

Commercial banks are defined as privately owned institutions that offer a broad range of deposit accounts, including checking, savings and time deposits, and also extend loans to individuals and businesses. Recently, commercial banks have begun to offer services beyond their traditional scope, such as brokerage and insurance services. We restrict our sample to the activities mentioned earlier that are considered the traditional "core" of commercial banking.

In order to identify a list of financial services in an objective manner with respect to our research question, we elected to include only services included on one or more of the corporate

websites of the five largest U.S. commercial banks as measured by assets in 2009. These banks were Bank of America, JP Morgan Chase, Citigroup, Wells Fargo, and PNC Financial Services (Hutchinson, 2009). We searched the websites of these five banks for both the personal and corporate services they offered. Via discussions with experts in the banks, we then distinguished the basic service types from the multitude of minor variations that banks typically offer – e.g., we included corporate sweep accounts, but did not include variations based upon the specific types of investments into which funds were swept.

In order to avoid bias in our analyses of the sources of our sample of successful service innovations, we next screened it to identify and exclude any service innovations which banks or non-bank producers were prevented from introducing at the time users developed them due to regulatory constraints. On this basis, we excluded digital "substitute checks" (electronic legally-acceptable substitutes for paper checks) because the commercial introduction of this service by banks was only made possible by The Check Clearing for the 21st Century Act, a federal law that took effect on October 28, 2004. We found no other cases of this type.

It is important to note that, because our sample contains only services that are *currently* offered by banks, we are looking at services that still survive a number of years after their commercial introduction. We have no information on services that banks may have commercially introduced at some point but have since dropped from their portfolio of offerings. Such services may show a different innovation pattern than the survivors.

Our sample of 36 corporate and retail banking services identified and screened in the manner just described are listed in our findings in Section 4.

3.2. Locus of innovation determinations

All of the services in our sample are offered by banks in computerized form today. To determine the locus of innovation for each, we investigated the history of every innovation in our sample *prior* to the date of its introduction as a computerized, commercially-provided service by a bank or other commercial service producer. Our goal was to determine whether one or more service users self-provided the function of each service *in a computerized form* before any bank, or other producers of financial services like accountants, offered it. Next, we searched for a prior manual version if there was one, and made the same determinations with respect to that innovation.

In the case of retail banking services, we searched for the history of innovative activities among banks, non-bank producers such as accounting firms, and individual retail customers. In the case of corporate banking services, we searched for innovations among banks, non-bank producers such as accounting firms, and corporate banking customers ranging from large firms such as Mobil Oil, to small firms such as construction companies.

As we were interested in determining which category of potential innovator – service user or financial service producer – was first to develop and implement each service in our sample, we did not need to determine which specific user or specific service producer was first to do this. To determine which category of potential innovator was chronologically first to use or offer each service in our sample, we first determined the date when each was first commercially provided by a bank or other type of financial service producer. We did this by searching in financial industry trade journals for the earliest discussions of and advertisements for commercial implementations of each service. Next, we searched for descriptions of users' best practices related to that service *prior* to that date. To identify these, we searched online, on Google Books, Google Scholar and so on, and in libraries for books on personal and corporate financial management by popular authors from the 1960s, 1970s and 1980s. For example, if a financial management book discussed use of a service from our sample as a "self-service" *before* it was first offered as a commercial service by a bank or other financial service producer, we coded it as a user-developed service.

Note that this method of locus of innovation determination is subject to the risk that the literature and experts might not be cognizant of innovations by small banks or by possible non-bank service producers like accountants. The risk of such biases is unfortunately inherent in any retrospective research. In our case, we can report that the literature did include mentions of innovations by small banks as well as large. For example, Verity Credit Union, a banking company of about 100 employees, was credited in the literature with creating the first bank blog in 2004. Similarly, the literature reported that John C. Biggins at The Flatbush National Bank of Brooklyn in New York developed in 1946 a credit plan named "Charge-it" (Gurusamy, 2009) – credited as the first effort to develop a bank credit card.

As we worked, we also obtained advice and information via telephone discussions with 14 expert informants with a long history in banking and financial services. This group consisted of 6 authors who had written on some aspects of banking services in articles published in academic and/or trade journals. Additional members were 6 banking executives from a mix of large and small banks, and 2 senior consultants who specialized in the financial services field.

Our detailed explorations of the innovation histories of computerized financial services in our sample of banking services in many cases uncovered the innovation histories of manual methods of similar function that preceded them. We explored the sources of these via processes identical to the processes applied to exploring the histories of computerized banking services that were described above.

4. Findings

During the period 1975–2010, the period covered by our study, banks were going through a major period of computerization of their internal processes. Today, almost all banking services offered, from telephone banking to payroll processing services, are computerized for reasons of economy, accuracy, and speed. In Section 4.1, we explore who was first to create a computerized version of each corporate banking service in our sample, users or financial service producers. In Section 4.2, we do the same for retail banking services in our sample. In Sections 4.3 and 4.4, we go further back into history, and document manual precursors that existed in the case of 16 of our sample of 36 computerized banking services that are offered today.

As illustration of what we term manual precursors to computerized banking services, consider the computerized 'keep the change' service introduced by Bank of America in October, 2005 (Tufano and Schneider, 2009). Users did not develop this service in computerized form, and so in our study we coded it as producer-developed. Still, prior user manual self-services we identified clearly have underlying functional similarities to – and therefore can be insight-generating with respect to – the computerized commercial service developed by Bank of America. For this reason, we credit users with the development of manual precursors to the 'keep the change' service.

Enrollees in Bank of America's computerized 'keep the change' service authorize the bank to automatically round-up the value of every debit-card purchase to the nearest dollar, and transfer the difference from their checking account to a traditional savings account. According to a senior executive of Bank of America interviewed by the authors, the idea for this service was triggered by a woman attending a Bank of America focus group. She told the interviewers that each time she wrote a check, she rounded up the

amount she wrote in her record of the transaction to the nearest dollar. As a result, the "change" from this rounding disappeared from her checkbook balance calculations and became a form of savings.

Our own literature reviews discovered several additional manual forms of "rounding up" by consumers as a way to put aside money for savings. For example, Porter (1975, p. 17) reported upon a common user practice of saving money in "change jars" at home when he advised his readers that a secret to saving is to: "Put aside at the end of each day all the change you have left in your pocket (. . .). Once every week, faithfully deposit your little hoard in a nearby bank or savings association" (Porter, 1975, p. 62). These "service precursor" user activities clearly can offer both need and solution ideas both to follow-on user developers of increasingly sophisticated self-services, and to commercial service producers as well.

4.1. Computerized corporate banking services

In Table 1, we summarize our findings regarding the first to develop our sample of computerized corporate banking services. Note that our Table 2 findings are grouped under three headings: (1) account information services; (2) account transaction services; and (3) new channels to access banking services. We did this because the constraints on user innovation appear to us to differ in the case of each of the categories listed. We speculate that bank innovation may well increase as we move from category 1 to category 3, with a related reduction in the proportion of innovation by users.

In category 1, account information services, no financial transaction or money transfer by the bank is involved. Services in this category involve processing information generated by users or provided to users by banks on the status and history of individual accounts. The goal of service innovations of this type is to generate more useful financial indicators and summaries, often across multiple accounts. In the case of category 2, account transaction services, implementing the service requires that a transaction must occur in which the commercial bank system "does something" in response to instructions from account holders. For example, a user might issue an instruction to pay X amount from Y account to party Z. With respect to category 3, it seemed to us that action by both users and banks must be involved: a functioning new channel between two parties requires that both parties have the appropriate transmitters and receivers, and that both "staff" the new access channel.

As can be seen in Table 1, the level of user innovation is indeed highest in category 1, and lowest in category 3. This seems reasonable to us, given that user access to the information and controls they need to innovate for themselves is likely to be increasingly difficult/costly as one moves from new service development opportunities in category 1 to those in category 3.

Table 2 identifies all services in our computerized corporate banking services sample. For each, the date of first commercial introduction by financial service producers is indicated (column 2), along with the date of earliest documented prior use by a corporation, if any (column 3). The coding of the locus of innovation (column 4) was done as follows. In instances when one or more user firms were using the service before banks or non-bank producers of financial services offered it as a commercial service the innovation is coded as user-developed (U). When banks or other types of financial service producers commercialized the innovation prior to any corporate user developing the computerized service for their own in-house use, there is no user innovation date, and the service is coded as producer-developed (P). When both user and producer jointly developed the innovation, the dates of user introduction and producer introduction in the table are the same, and the service innovation is coded as joint (J) (identical codings are used in Tables 2, 4, 6 and 8).

In the case of corporate services, 6 of our 20 cases have a common origin – they were first created as part of a pioneering electronic data interchange (EDI) system (e.g., Sokol, 1995) developed collaboratively by GM and a group of its major suppliers. In the initial stages of development in the early 1980s, banks were not included in this consortium, and information exchange services developed stopped short of actual financial transfers (GM itself owned GMAC, at that time a non-bank producer of some financial services. However, GMAC was never part of GM attempts to develop EDI, and played no role in the development of the services that we analyze in this paper). In 1985, the consortium was extended to include 8 banks, so that actual payments as well as information regarding transactions could flow through the system via the common, user-developed EDI format.

Even though it was clear from the written histories that user firms and not banks were the dominant developers in this consortium, we conservatively coded these services as joint innovations, with the single exception of invoice processing. The initial invoice processing service developed did not involve money transactions, and was implemented without the involvement of banks (Gregory and Palmer, 1988; Jimison and Feder, 1990).

The development histories of the remaining 14 corporate service offerings in our sample were totally independent cases. For example, computerized payroll processing – automated calculation of taxes and other matters associated with wage payments to employees – was pioneered in the early-1950s as a self-service by J. Lyons and Co. This user firm, a major baking and catering firm in the UK, innovated independently of others. The software involved was developed by J. Lyons and Co. for its own use (Bird, 1994; Ferry, 2003). In the US, GE was also an early user firm as it developed payroll software for its own use on the UNIVAC computer in early 1950s (King, 2006).

4.2. Computerized retail banking services

The possibility that individual retail customers might develop computerized bank services for themselves prior to banks or other types of financial service producers offered them commercially might initially seem surprising – but, as Table 3 shows, this was in fact the case for 44% of present-day retail banking services.

As in the case of corporate banking services, we see in retail banking services that users are most active in innovating in the processing of their retail banking information by computer.

As illustration, consider the service of "multiple institution account information aggregation" (Table 4). This financial service automatically contacts each financial institution where a retail user has an account, logs on using the user's password, collects information on the account status (balances, etc.), logs off, and then assembles the information from all accounts into a convenient spreadsheet tailored to the user's specifications. Commercial versions of this service were first introduced by non-bank financial service producers (e.g., Yodlle in the late 1990s) and then eventually by banks.

Well before the late 1990s, however, many users were already polling their accounts manually and putting the data into multi-account spreadsheets for themselves. Further, some users had developed fully or partially automated versions of the services very like the commercial services eventually offered. These generally acquired their data via "screen scraping." (screen scraping involves collecting data intended to be used for display on a user's viewing 'screen', and converting it into a form that can be used as input to a computer program).

Consider this personal history:

> I do my banking online, but I quickly get bored with having to go to my bank's site, log in, navigate around to my accounts, and check the balance on each of them. One quick Perl mod-

Table 1
Sources of computerized versions of corporate banking services.

Service types	% User	% Producer	% Joint
Information services and planning solutions	75%	25%	0%
Products, transaction services and security	61%	8%	31%
Channels to access banking services	0%	67%	33%
Corporate services total	55% (11)	20% (4)	25% (5)

> ule (Finance:Bank:HSBC) later, I can loop through each of my accounts and print their balances, all from a shell prompt. With some more code, I can do something the bank's site doesn't ordinarily let me do: I can treat my accounts as a whole instead of as individual accounts, and find out how much money I have, could possibly spend and owe, all in total. (Hemenway and Calishain, 2004, p. 62)

Table 4 identifies all services in our computerized retail banking services sample. For each, the date of first commercial introduction by banks or other financial service producers is indicated (column 2), along with the date of earliest documented prior use of the computerized service by individual users of the retail service if any (column 3). In instances when one or more individual users were using the service before it was offered as a commercial service by financial service producers the innovation is coded

Table 2
Sources of innovation and dates of introduction of computerized *corporate* banking services.

Corporate banking services in sample ($n = 20$)	Date of commercialization of computerized version of service	Date of introduction of computerized version by user as a self-service	Innovator U = user, P = producer, J = joint (producers are banks or other types of commercial service providers)
Information services and planning solutions			
Multiple institution information aggregation	1999[a]	Mid 1980s[b]	U
Online corporate forums and communities	2004	1985[c]	U
Corporate taxes preparation and computation	Early 2000s[d]	1960s	U
Alerts, notifications and reminders (tel./email)	Early 2000s	None	P
Products, transaction services and security			
Payroll processing services	Early 1980s[e]	Early 1950s[f]	U
Payment processing services	Mid-1980s	Mid-1980s	J
Invoice processing services	2006[g]	1968[h]	U
Remote payment/payroll services	Late 1990s[i]	1957[j]	U
Corporate salary account	Late 1980s	Early 1980s	U
Lockbox	Mid-1980s[k]	Mid-1980s	J
Sweep services within the same bank	Mid-1980s[l]	Mid-1980s	J
Sweep services between different institutions	2010	Mid-1980s	U
Zero balance accounting	1976[m]	Early 1970s[n]	U
Risk assessment/computerized	Mid-1990s[o]	1985[p]	U
Overdraft protection	Late 1990s[q]	None	P
Merchant services and card solutions	Early 1980s	1940[r]	U
Remote deposit	2004[s]	2004	J
Channels to access banking services			
Data link with bank	1985[t]	1985	J
Telephone banking (via voice response tech.)	Early 1980s[u]	None	P
Online banking	1995[v]	None	P

[a] Yodlee introduced account aggregation in 1999 (Spiotto, 2002).
[b] Prior to Yodlee, firms aggregated their accounts and other assets using accounting software packages to put together their overall assets and calculate their net worth (e.g. InforWorld 16 Nov 1987, InfoWorld 4 Abr, 1988, Godin and Lim, 1998).
[c] Armstrong and Hagel, 1996, 1997.
[d] Cortada (2007).
[e] Introduced in the beginning of the 1980s "It's a little known secret that we've offered the service for that long" said Bob Brown, senior Vice President of Wells Fargo (Dullum, 2002, p. 2).
[f] A bakery and catering company in the UK is credited for developing the first payroll system (e.g., Caminer et al., 1996; Bird, 1994; Ferry, 2003). As Ferry (2003) reports "the world's first business computer was not the product of an electrics or business machine giant, but of a catering giant: J. Lyons & Co.".
[g] "Bank of America was the first bank to offer this service in June 2006" Skinner (2008, p. 272).
[h] Sokol (1995).
[i] Haug (2000).
[j] Haug (2000).
[k] We consider the date when GM created a consortium with suppliers and banks that made it possible to offer lockbox accounts.
[l] We consider the date when GM created a consortium with suppliers and banks, even if according to Anderson and Rasche (2001, p. 51) "The use of deposit-sweeping software spread slowly between January 1994 and April 1995, but rapidly thereafter".
[m] Business Week (1976) announced the first Zero Balance Account by banks, indicating that prior to the first account, setting up separate accounts had long been the practice of large corporations.
[n] Bhalla (2005, p. 107).
[o] Vasarhelyi et al. (2005, p. 33).
[p] The first computer banking system, HOBS, was launched by Bank of Scotland in 1985 and risk assessment became computerized.
[q] US Congress (2007).
[r] Mobil oil, a user firm, issued the first credit card in 1940 in order to give specialized services to its regular customers. The origin of the first bank credit card can be traced to the launching of a credit plan called "Charge-It" in 1946 by the Flatbush National Bank of Brooklyn, New York (Gurusamy, 2009, p. 43–44).
[s] Van Horne and Wachowicz (2008, p. 227).
[t] Gregory and Palmer (1988), Jimison and Feder (1990), King (2006).
[u] Despite early evidence of users using the phone to initiate banking transactions, we were conservative and considered the early 1980s as the date when telephone banking became popular.
[v] Wells Fargo (http://en.wikipedia.org/wiki/Wells_Fargo) and Security First Network Bank were the first financial institutions to offer Internet banking in 1995.

Table 3
Sources of computerized versions of retail banking services.

Service types	% User	% Producer	% Joint
Information services and planning solutions	75%	25%	0%
Products, transaction services and security	38%	62%	0%
Channels to access banking services	25%	75%	0%
Corporate services total	44% (7)	56% (9)	0% (0)

Table 4
Sources of innovation and dates of introduction of computerized *retail* banking services.

Retail banking Services in sample ($n = 16$)	Date of commercialization of computerized version of service	Date of introduction of computerized version by user as a self-service	Innovator of computerized version U = user, P = producer, J = joint
Information services and planning solutions			
Multiple institutions information aggregation	1999[a]	Early 1980[b,c]	U
Relationship statements	Early 1990s[d,e]	Early 1980[f]	U
Online consumer forums and communities	After 1995[g]	1985[h]	U
Alerts, notifications and reminders (tel./email)	Early 2000s	None	P
Products, transaction services and security			
Electronic person-to-person (P2P) funds transfer	January 2010	1990s[i]	U
Personal budget planner	1986[j]	1980[k,l]	U
Manual/automatic bill paying	Shortly after 1975	None	P
Sweep service between accounts in the same bank	1994[m]	None	P
Sweep services across different institutions	2010	1997	U
"Keep the change" program	October 2005[n]	Early 2000s[o]	P
Overdraft protection	Late 1990s[p]	None	P
Frequent password updating	2007	None	P
Channels to access banking services			
Telephone banking	Early 1980s[q,r]	None	P
Text messaging services	2009[s]	None	P
Online banking	1995[t]	None	P
Mobile banking	Mid-2000s	October 1999[u]	U

[a] Yodlee introduced account aggregation in 1999 (Spiotto, 2002).
[b] Popular Science February 1983.
[c] Hemenway and Calishain (2004, p. 62) show evidence of users (hackers) doing account aggregation using screen-scrapping before Yodlee became commercially available.
[d] Popular Science, Feb 1983, p. 71.
[e] During the mid-1990s Fidelity Investments redesigned one of the first consolidated relationship statements for its retail—non-institutional—customers. http://www.dpsmagazine.com/content/ContentCT.asp?P=315.
[f] Popular Science Feb 1983.
[g] The first web-based banking initiative were introduced in 1995 (Network World, 13 Jul 1998, p. 49), which means online forums were introduced after that.
[h] Armstrong and Hagel (1996).
[i] Cell phones were introduced in Kenya in the 1990s and immediately users started using them to transfer "air-time", which is equivalent to transferring money, as air-time can be exchanged for money.
[j] Banks started adopted Quicken solutions in 1986.
[k] Swaton (1981) discussed commonsense rule that apply to personal budget preparation.
[l] Kiplinger's Personal Finance, Jul 1983, p. 60.
[m] Anderson and Rasche (2001).
[n] Tufano and Schneider (2009).
[o] Individual users have electronically developed similar practices to save money. http://www.getrichslowly.org/blog/2010/06/01/money-hack-when-you-save-money-put-it-in-savings/.
[p] US Congress (2007).
[q] Markham (2002, p. 290).
[r] "Banking by phone: customers in Fardo, N.D. have become the first in the nation to be able to do banking and a lot of other things over a two-way videotext-system". Popular Science, September 1982, p. 126.
[s] http://www.prnewswire.com/news-releases/frost-introduces-text-messaging-to-frost-mobile-banking-services-93933274.html.
[t] http://en.wikipedia.org/wiki/Wells_Fargo.
[u] The Nokia 7110 was the first mobile phone with a WAP browser. It was introduced in October 1999 allowing users to access their bank's websites.

as user-developed. When banks or other types of financial service producers commercialized the innovation prior to any retail user developing the computerized service for his or her own in-house use, there is no user innovation date, and the service is coded as producer-developed. When both user and producer jointly developed the innovation, the dates of user introduction and producer introduction in the table are the same, and the service innovation is coded as jointly-developed.

As was shown in Table 3, retail service users were most active in innovating with respect to processing financial information they obtained from banks and other producers into a more convenient form only later offered by banks – e.g., aggregating information from multiple accounts onto personal computer spreadsheets for more convenient processing and analysis. Interestingly however, as Table 4 shows, users also were able to pioneer mobile banking – a channel-related innovation. Channels do require that both ends of the channel be set up – so that there is both a sender and receiver linked together as a system. When a channel is built from scratch, both ends must be constructed simultaneously, and such innovations are for that reason coded as joint. However, sometimes one end of the channel has been set up for an earlier purpose, and in such cases, one actor is free to exploit the preexisting channel to create the new service without the requirement of joint action. Internet banking via cell phone – "mobile banking" is an example of this, and is for this reason is coded as a user innovation in Table 4. As soon as cell phones became Internet-enabled, customers had the

technology in hand to access preexisting Internet banking channels via this device. Initially, users found it difficult to do so, but persevered. The problem was that banks had not expected users to access the channel via cell phone, and so the web pages on bank Internet banking sites had been designed with the screen size of a personal computer in mind. When banks became aware of the new user practice, they created "mobile banking" web pages to make them more appropriate for cell phone screens.

4.3. Sources of manually-implemented corporate banking services

Current computerized banking services – whether developed by users or by banks – often have an earlier precursor in the form of manually-implemented service processes of similar function. In our study, we were able to identify these manual precursors for 13 of the 20 services in our corporate banking services sample. As can be seen in Table 5, user firms dominate this type of innovation, creating 12 out the 13 innovative services in this subsample.

Table 6 identifies all manual versions of banking services in our corporate banking services sample. For each, the date of first commercial introduction by banks or other types of financial service producer is indicated (column 2), along with the date of earliest documented prior use of the computerized service by user firms if any (column 3). Sources of innovation for manual versions of corporate banking services in Table 6 were coded by the same criteria used for Tables 2 and 4, described earlier.

As can be seen in Table 6, financial service producers seldom commercialized manual services pioneered by users in a manual form. Instead, they generally offered no service having that functionality until they could offer the service in computerized form.

An exception, as can be seen from the table, is lockbox services. Lockboxes enable a company to receive checks by mail at a special post office box address. Prior to the introduction of lockbox services by banks, companies self-provided that service. Companies would arrange to receive customer payments at a special post-office "lockbox" mailing address, would open all correspondence as soon as received, deposit checks received into their bank accounts several times a day, and in that way put the money to work immediately. In 1947 Radio Corporation of America arranged with the First National Bank of Chicago and Bankers Trust Company to create a bank-provided lockbox service in Chicago, Ill., and New York, N.Y. To provide the commercial service in a manual form, *bank* employees carried out the manual steps formerly carried out by users as a self-service. Since the banks simply offered the manual procedures pioneered by the user firms as a commercially-provided service, this service was coded as user-developed.

4.4. Sources of manually-implemented retail banking services

Finally, we come to manually implemented *retail* banking services that were precursors to computerized retail banking services being offered by banks today. As can be seen in Table 7, users are the major developers of these types of services, pioneering 8 out of 10 service innovations in this subsample.

Table 8 identifies all manual versions of banking services in our corporate banking services sample. For each, the date of first commercial introduction by banks or other types of financial service producers is indicated (column 2), along with the date of earliest documented prior use of the computerized service by user firms if any (column 3). Sources of innovation for manual versions of retail banking services in Table 8 were coded by the same criteria used for Tables 2, 4 and 6, described earlier.

As illustration of development of a manual precursor of a retail service today offered in computerized form, consider "sweep accounts." Sweep accounts are intended to increase customers' interest income: money a customer does not plan to spend immediately can be "swept" from a checking account into a savings account offering higher interest rates, and then returned to a checking account as needed. Banks offered automated sweep account services first to corporate customers in the 1980s, and then to the retail market in 1994 (Cantillon and Franzke, 1998). At the time of commercial introduction of a computerized sweep account service by banks, the sweep account function was *not* novel to many users. Long before banks offered such a service, many retail (and commercial) customers had long made it a practice to periodically sweep money between their checking and savings accounts in order to increase their interest income. They did this by issuing transaction-specific instructions manually to their banks. In other words, users were serving themselves with a manual sweep account service. Banks, as is shown in Table 8, never did offer a manually-implemented sweep account service. However, as is shown in Tables 2 and 4, they do today offer computerized sweep account services to both their corporate and their retail clients.

5. Discussion

We have found that, in the case of important banking services, users frequently develop and self provide what they need before banks or non-bank financial service producers offer commercial services to serve their needs. In the remainder of this section we discuss the likely generalizability of our findings (Section 5.1), managerial implications (Section 5.2) and suggestions for further research (Section 5.3).

5.1. Towards generalizability

Our first quantitative study of the sources of important service innovations has been focused on financial services. Every industry and time period has special traits, and it will be important to do empirical research in other fields and times as well to empirically establish the generalizability of the patterns we have documented. Thus, in the case of banking services, a special attribute of the period we studied was that both banks, other types of financial service producers, and customers were engaged in the computerization of their internal processes at a massive scale (The Economist, 2010). This historic change certainly created major new opportunities for both producers and customers to build new services upon their individual and joint new technical capabilities. However, it may not have differentially affected the innovation roles of users and producers.

Our own expectation is that further empirical research will find that users are the initial developers of many of the services they need (via self-service versions) across a broad range of fields and conditions. We have three reasons for this expectation. First, users generally understand their needs better than do producers. After all, need information originates with users, and there is often a significant cost involved in transferring that information to producers – the information is often "sticky" (von Hippel, 1994; Ogawa, 1998). Second, emergent needs that will become general are encountered first by lead users situated at the leading edge of markets. The nature and extent of demand is both small and uncertain at the leading edge, and so the potential commercial opportunity often does not appear attractive for commercial producers at this stage of market development (von Hippel, 2005; Baldwin et al., 2006). Third, at least some users facing a given leading-edge need will be able to develop a service innovation for themselves at very low cost. It will fall within their personal or corporate 'low-cost innovation niche' as users because of their specific preexisting expertise and tools and, very importantly, their ability to conduct low-cost trial-and-error development within their own user environments (Lüthje et al., 2005; Tyre and von Hippel, 1997).

Table 5
Sources of manual versions of corporate banking services.

Service types	% User	% Producer	% Joint
Information services and planning solutions	100%	0%	0%
Products, transaction services and security	100%	0%	0%
Channels to access banking services	0%	0%	100%
Corporate services total	92% (12)	0% (0)	8% (1)

Table 6
Sources of innovation and dates of introduction of *manual* versions of corporate banking services.

Corporate banking services in subsample ($n = 13$)	Date of commercialization of manual version of service, if any	Date of introduction of manual version by user as a self-service	Innovator of manual version U = user, P = producer, J = joint
Information services and planning solutions			
Multiple institution information aggregation	None	Before 1980s	U
Corporate taxes preparation and computation	None	Before 1960s	U
Alerts, notifications and reminders (tel./email)	None	Mid-1980s	U
Products, transaction services and security			
Payroll processing services	1922	1905[a]	U
Payment processing services	None	Early1900s[b]	U
Invoice processing services	None	Early1900s	U
Corporate salary account	None	1970s[c]	U
Lockbox	1947	Before 1947	U
Sweep services between accounts within the same bank	None	Before 1980s	U
Sweep services between different institutions	None	Before 1980s	U
Risk assessment	1900s	1781[d]	U
Overdraft protection	none		U
Channels to access banking services			
Telephone banking (via an operator)	Early 1980s	Early 1980s[e]	J

[a] Haug (2000, p. 70).
[b] Strom (1992, p. 19).
[c] Haug (2000, p. 146).
[d] Since the foundation of the first bank in the US, the Bank of North America at Philadelphia in 1781 banks have been performing risk assessment for themselves when they consider lending money (according to a report by Horace Binney who was president of the bank).
[e] Despite early evidence of users using the phone to initiate banking transactions, we were conservative and considered the early 1980s as the date when telephone banking became popular.

Table 7
Sources of manual versions of retail banking services.

Service types	% User	% Producer	% Joint
Information services and planning solutions	100%	0%	0%
Products, transaction services and security	100%	0%	0%
Channels to access banking services	0%	0%	100%
Corporate services total	80% (8)	0% (0)	20% (2)

It also seems reasonable that user-developed manual or in some other way crude 'precursor' services that pioneer the functionality of more sophisticated services later developed will also generally exist. Consider, in this regard, that individual services (and products) are really only modules in larger systems of interconnecting activities – and the modules only have utility in the context of a complete system. At the leading edge, therefore, where markets are small and uncertain, lead users will generally be the ones

Table 8
Sources of innovation and dates of introduction of *manual* versions of retail banking services.

Retail banking services in subsample ($n = 10$)	Date of commercialization of manual version of service, if any	Date of introduction of manual version by user as a self-service	Innovator of manual version U = user, P = producer, J = joint
Information services and planning solutions			
Multiple institutions information aggregation	None	Before 1980s	U
Relationship statements	None	Before 1980s	U
Alerts, notifications and reminders (tel./email)	None	Before 1980s	U
Products, transaction services and security			
Personal budget planner	None	Early 1960s	U
Manual bill paying	1975[a]	Before 1960s	U
Sweep service between accounts in the same bank	None	Early 1960s	U
Sweep services between different institutions	None	Early1980s	U
Overdraft protection	None	Early1980s	U
Channels to access banking services			
Telephone banking	Early 1980s[b]	Early 1980s[b]	J
Text messaging services	2009/2010[c]	Early 1993[d]	J

[a] Shortly after 1975 banks started making payments of insurance premiums, automobile installment loan payments, telephone and water (Porter, 1975).
[b] Markham (2002, p. 290).
[c] http://www.prnewswire.com/news-releases/frost-introduces-text-messaging-to-frost-mobile-banking-services-93933274.html.
[d] Text messaging was first used in December 1992.

to innovate at the system level (von Hippel, 1977). They will do this by stringing together available or self-provided service modules into larger combinations that, when used together, create a total system to generate a desired outcome. For example, when individuals or firms wish to manage their financial affairs they need *complete*, even if not sophisticated, multi-module financial and accounting systems to accomplish this. Thus, users must have a way to bill for what they are owed, *and* receive funds, *and* have a place to store or invest assets, *and* track what they have, *and* track what they owe, *and* have a way to disburse funds to make even the most primitive complete and functional financial system.

Of course, as we mentioned at the start of this paper, we expect user innovation only for services where users *can* 'serve themselves,' and so have an opportunity to innovate via "learning by doing." Within financial services, improved bank check clearing processes would be an example of a specific service type where we would not expect user innovation: check clearing is a process done within and among banks, and banks have not historically granted users the access or right to improve or modify their internal processes.

We also expect that users will only develop service innovations from which they expect to benefit. There are service innovations that require changes by users – but that offer no benefit *to* users. In such cases we would not expect to see users developing the innovation. For example, we would not expect banking customers to invent the system that enabled banks to save costs by switching from human telephone operators to a telephone menu "service" ("press 7 to reach a loan officer").

5.2. Managerial implications

There are clear practical implications of our findings for service producers seeking to innovate. First, it is useful to recognize that service innovations, just as is the case for product innovations, are often first developed by lead users. For this reason, it will be useful for producers to consider searching for actual service innovations by lead users, as a supplement to or even substitute for 'co-development' of innovations with users as suggested by Prahalad and Ramaswamy (2002) and others mentioned in our literature review. The advantages that searching for lead user innovations can provide over producer self-development have been discussed and documented elsewhere (Lilien et al., 2002; von Hippel, 2005). In essence when firms use lead user innovations as inputs to their product or service development processes, they obtain information on leading edge user needs. They also obtain information on prototype product designs responsive to those needs, and information on the value in use derived from deployment of those user-developed prototypes under real-world conditions.

It will be especially valuable for service producers to seek out the self-service innovations of lead users when these innovations contain functional novelty. Here users have a major advantage over producers with respect to privileged access to sticky need information – they are the generators of that information. In contrast, when the service innovation issues involve less functional novelty "dimension of merit improvements" – inputs from lead users are less likely to be essential (Ogawa, 1998; Riggs and von Hippel, 1994; Roy, 2009).

Recall from Section 5.1 that services provided by commercial producers are modules in larger user systems of interlinked products and services. A good way for a particular producer to search for additional commercial services opportunities, therefore, is to explore these user systems to identify modules that precede and follow those that the service or product producer now provides. For example, users know what they do with financial data before and after they utilize commercially-produced financial services. They may, for example, use the data in budgeting or in tax preparation. To service producers, these "adjacent" activities in the larger user system are not automatically visible, and so must be purposefully identified and explored.

Firms that supply service functions "adjacent" to new service opportunities currently being provided by users for themselves have an advantage over other potential producers. They have economies with respect to already having some or much of the information needed to provide the adjacent service in hand. They also already have the customer relationship in hand as a result of their current provision of the adjacent service. The economic considerations here are similar to those involved in analyzing the costs and benefits of vertical integration.

An interesting side effect of the substitution of a self-provided service by a commercial one is that, often, the service introduced by a firm takes away users' freedom to make modifications and adjustments on their own. For example, in earlier days, when users aggregated and reconciled their own monthly banking activities in a ledger, they could set up and adapt and evolve this ledger precisely according to their preferences – the service was user-adjustable. Once banks introduced a commercial multi-account reconciliation statement, users abandoned personal ledgers because of the gain in convenience. This shift from a self-provided to a firm-provided service, however, also meant that users sacrificed their prior easy ability to tailor and retailor the service. The reconciliation format was now set by programming choices made within the bank, and the tools to adapt it were not accessible to banking customers.

When producers offer commercial versions of user-developed services, they should consider the value of offering these in the form of "toolkits" that retain users' ability to modify and update these on their own. If users *can* modify and build improvements upon the service offered by a commercial producer many will do so. Producer can then study these user-developed improvements as a valuable feedstock of potential improvements to their commercially-offered service (Franke and von Hippel, 2003). Toolkits enable a user-only service development and testing process carried out by users in their own actual user environments at no cost to service developers.

5.3. Limits of this study and related suggestions for further research

The study reported upon here is the first quantitative empirical study of the sources of innovation in services. For reasons described earlier, we think findings from this study will be generalizable beyond financial services – but only further research will enable us to know for sure. For this reason plus others, there is a clear need for studies of the role of users in the development of additional types of services.

In this study our sample consisted only of innovations that were commercialized by banks. At the same time, there is certainly a range of user-developed self-services that are not offered commercially by banks. Further studies might wish to explore non-commercialized as well as commercially-offered services in order to get a fuller picture of the full range of services.

In this study, our sample consisted only of important, successful services (recall that we included only services currently offered by major banks). A sample that also included failed services would allow researchers to explore additional matters, such as whether services that were user-developed and field-tested prior to commercialization are more or less likely to fail commercially than services with lesser amounts of user prototyping and field testing.

With respect to methodological issues, recall that our research relied on written records plus interviews to determine the sources

of innovation. Both of these sources are of course incomplete and may well have a bias towards more prominent parties, and also those with a higher incentive to make their innovations known. In our specific case, this is likely to create an information bias favoring larger producers. Producers, after all, have a need to sell, and so may advertise. A lack of full information may also create a bias in the opposite direction towards a finding of innovation by users. Recall that users are the default innovators in our methodology. If an innovation exists and we cannot find a producer-innovator, the innovation is presumed to have been user-developed. It is not clear how to avoid these types of biases in future work on the topic – the historical record is inevitably incomplete.

It is important to note that service producers and users can define services broadly or narrowly: for example, one producer may offer a very aggregated banking service 'that covers all your banking needs' while others may offer customers an array of more narrowly-specified component services like sweep accounts (analogously, in the field of household services, some service vendors may offer a 'complete house cleaning service' while others may offer separable component services such as window cleaning or laundry services). Our way of establishing a clear sample selection rule for this study was to choose in each instance the level of aggregation specified by the major banks themselves in their web-advertised descriptions of services on offer. We did this because the goal of our study was to show where banking services, as defined by banks, came from. Others may wish to take other approaches for other purposes. For example, historians may wish to disaggregate to the point that the histories of independently-created elements of what are today considered a single service can be teased out.

We conclude by noting that the findings in this paper provide a first indication that users may often develop self-services that are later adopted and adapted by commercial service producers. Development and field use of new services by users independent of service producers has not yet been explored in the service development literature. The likely common presence of this pattern in the field suggests new interesting new questions for both research and practice.

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Appendix A.

See Table A1.

Table A1
Important retail and corporate banking services offered by banks prior to 1975 – and for this reason not included in our sample.

Retail banking services	*Information services and planning solutions*	*Sources:*
	Monthly statement on individual checking	(Porter, 1975); Banking expert interview
	Products, transaction services and security	*Sources:*
	Checking (or demand) accounts	(Porter, 1975)
	Savings and time deposits	(Porter, 1975); Time deposits authorized by Federal Reserve Act of 1913 (Klebaner, 1990)
	Mortgages and home improvements loans	(Porter, 1975)
	Credit for automobiles, appliances, the whole range of big-ticket and small-ticket items	(Porter, 1975)
	Personal and student loans	(Porter, 1975)
	Trust, investment, estate, and custodian services	(Porter, 1975)
	Financial counseling	(Porter, 1975)
	Letters of credit	(Porter, 1975)
	Safe deposit boxes	(Porter, 1975)
	Travelers checks	(Porter, 1975)
	Christmas and vacation clubs (pay interests)	(Porter, 1975)
	Credit card	Introduced in 1958 (Evans and Schmalensee, 2005)
	Customer loyalty reward programs	(Blake, 1974)
	Certificates of deposit (CD)	Banking expert interview
	International currency exchange	Banking expert interview
	Channels to access banking services	*Sources:*
	Bank branches and tellers (including drive-in facilities)	The first incorporated bank open in 1782 (Klebaner, 1990)
	Evening and Saturday banking hours	(Porter, 1975)
	ATM	Introduced in the late 1960s (Klebaner, 1990)
	After hours branch depositary	Banking expert interview
	Bank by mail	Banking expert interview
Corporate banking Services	*Information services and planning solutions*	*Sources:*
	Monthly statement on checking and loan accounts	Banking expert interview
	Products, transaction services and security	*Sources:*
	Checking (or demand) accounts	(Porter, 1975)
	Savings and time deposits	(Porter, 1975); Time deposits authorized by Federal Reserve Act of 1913 (Klebaner, 1990)
	Billing and fee-collecting services	(Porter, 1975)
	Financial counseling	(Porter, 1975)
	Farm and business loans	(Porter, 1975)
	Wire transfers	Most international transfers are executed through SWIFT, a co-operative society, founded in 1974
	Clearinghouse	The NY Clearing House Association, the nation's first and largest, was created in 1853
	Channels to access banking services	*Sources:*
	Bank branches and tellers	The first incorporated bank open in 1782 (Klebaner, 1990)
	After hours branch depositary	Banking expert interview
	ATM	Introduced in the late 1960s (Klebaner, 1990)
	Bank by mail	Banking expert interview

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