Technological Innovation Studies Program

Research Report

TECHNOLOGICAL CHANGES IN BANKING AND THEIR EFFECTS ON EMPLOYMENT

by

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The University of Calgary

January 1977

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Industry, Trade and Commerce
Technology Branch
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Technological Changes in Banking and Their Effects on Employment[1]

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The Nature of Technological Changes

The nature of technology that is being implemented by Canada's chartered banks has been examined rather comprehensively in two issues of the CIBC's Commercial Letter.[2] Therefore, only a brief statement on the subject should suffice.

Central to the new technology is the so-called third generation computer equipment, which in addition to storage and computational capabilities it has logical potential -- the ability to make programmed decisions, to examine multiple cases, make selections and optimize; it has memory -- the ability to receive information, store it in memory banks, and provide it to users upon request; and it has graphic potential -- the ability to provide the information in a variety of configurations, such as tables, charts, drawings and lines.[3]

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[1]This article is part of an ongoing study on the effects of technological changes on educational and skill requirements, on the occupational mix of manpower, and on changes in work functions. It is largely based on interviews, responses to letters of inquiry and responses to a questionnaire that was completed in late 1976. Research for the study has been funded by the Technology Branch of the Federal Department of Industry, Trade and Commerce.

[2]"Computers and Banking -- A Second Look", May/June 1974; and "Communications and Computers", Issue No. 2, 1977.

[3]A good analysis of the actual and potential application of computer technology will be found in a paper by J. Scrimgeour, entitled "CAD/CAM and its Significance to Canadian Industry", presented at the 1975 Annual Congress of E.I.C., in Winnipeg, Manitoba (September 30 - October 3, 1975).

Initially computer technology was applied to routine labour intensive banking operations, such as recordkeeping and cheque sorting.[4] Gradually application was extended to batch processing and other activities, and at present most of the chartered banks either have instituted or are in the process of instituting "on-line" storage and operating systems designed to facilitate the instantaneous processing and retrieval of information. The new systems not only store and process information in accordance with programmed instructions, but also compute automatically average balances and service charges, and carry out "on-line" updating of savings accounts, demand deposit accounts, installment loans, credit card accounts, and scores of other transactions. It is expected that within a few years every chartered bank will have a fully integrated national computer-communications system. Minicomputers and microcomputers will facilitate access to flow and stored information at every office and work station.[5]

Reasons for Investing in Computer-Communications Systems

Five major considerations appear to have entered into the decision to invest in computer-communications systems: (1) the rather substantial expansion in banking operations, and in the range of banking activities over the recent past, (2) anticipations of continued expansion; (3) quest for increase in efficiency in the rendering of customer services, and the

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[4] An estimated 1.75 billion cheques were written in 1974. Considering that each cheque is handled on the average fourteen times, manual sorting and processing would have been prohibitively costly. CIBC, Commercial Letter, May/June 1974, pp. 1-2.

[5] Who will have access, to what information and for what purposes are matters of extreme importance, not only from the standpoint of confidentiality, but also from the standpoint of the allocation of responsibilities within the organizational structure. The "on-line" system facilitates managerial centralization, and as such it can cause conflicts within the organizational structure.

concomitant reduction or at best a relative stabilization in operating costs; (4) the need for more comprehensive and up-to-date information on a continuous daily flow basis; and (5) the potential for more effective management planning and control.

Canada's chartered banks have recorded a phenomenal rate of growth over the 1965-1975 decade: in December 1965 their total assets amounted to $26,233 million; by December 1975 they stood at $108,378 million -- a fourfold increase within the relatively brief period of one decade; their loans increased from $9,124 million to $41,520 million or four-and-a-half times; their Canadian deposits increased from $18,594 million to $66,873 million or about three-and-a-half times; and their personal chequeing accounts increased from $207 million to $2,539 million or about twelve times.[6]

Some of this growth is, of course a manifestation of rising money incomes; between 1965 and 1975 the average money income of families and unattached individuals increased from $5,799 to an estimated $14,500 or by 150 percent. As a result, even in the absence of any changes in the nature of banking operations, deposits could have been expected to increase proportionately or one-and-a-half times. The increase of three to four times indicates that there has been a very significant real growth in the banking industry.

Expansion in operations of the magnitude experienced by the industry within the relatively short period of one decade cannot but have imposed serious strains on the organizational structure and management of

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[6] All statistical information is from the Bank of Canada Review May, 1976.

the industry. The mechanization process and experimentations with alternative organizational systems and managerial configurations can be viewed as responses to the pains of growth, and a manifestation that existing operational procedures and managerial structures and practices could not accomodate the rapid rate of growth.

The installation of "on-line" processing will undoubtedly speed-up day-to-day operations, expand the range and efficiency in rendering customer services, and facilitate more informed decision-making at all levels of the management structure. As a customer of a branch which was recently linked to an "on-line" system, I can attest myself to the considerable increase in efficiency in relation to customer services: no longer does the teller leave the station (wicket) and go in search of records to ascertain the account balance; when transferring funds from the savings account to the demand deposit account, it is no longer necessary to search for and pull out the savings account card and record the transfer; when information is requested on whether a given cheque has been cleared, it is no longer necessary to leave the station and go in search of the cheques that had been cleared, examine them and return them to the designated place. Indeed, in response to such a request I was provided within seconds with an up-to-date statement of all cheques that had been cleared within the previous fourteen days! It remains to be determined whether the evident improvement in customer services becomes reflected in a reduction or relative stabilization in operating costs.

Concurrent with the improvement in customer services, there is now a continuous flow of comprehensive current information on operations. The ways in which management will respond to the availability of that

information, and the uses to which the information will be put, will determine what will happen to operating costs. As Theodore Levitt has put it: "What makes scientific knowledge, inventions, and machines productive is not their mere existence, but how they are used -- how they are directed, organized, and managed."[7]

It is generally recognized, for example, that "on-line" computer-communications systems facilitate managerial centralization. Senior management will no longer rely on branch officers to provide information on branch operations; they can have the information in whatever form they wish before branch officers do. This potential for instant and continuous supervision of total operations can create an environment of Orwellian surveillance. If such an environment is allowed to develop, banks will find it even more difficult than has been their experience heretofore, to induce qualified employees to accept promotions.[8] Some agitation amongst intermediate management (branch managers) is already in evidence; the time is now critical for decisions on organizational structures and managerial configurations which will take into account the instantaneous access to the flow of operational information and the centralization that is facilitated by the system.

The Employment Impact -- General Discussion

The introduction of electronic data processing equipment should manifest itself in two employment effects: (1) a reduction in the rate

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[7] "Management and the Post-Industrial Society", Dialogue, volume 10, 1977, No. 1, p. 38.

[8] At a 1975 symposium on corporate planning, Irvin J. Dyck noted "a tendency on the part of employees to decline promotions." Corporate Manpower Planning in Canada: Trends and Prospects, The Conference Board in Canada, Ottawa, 1976, p. 46.

of increase in employment; and (2) the emergence of a number of new employment categories.

Reference was made above to the suggestion that the rate of expansion in banking operations would have been arrested in the absence of the new technology. Conventional methods of operation were becoming an obstacle to substantive increases in the volume and diversity of operations -- the conventional system would not have been able to handle the volume of work entailed in a fourfold increase in operations. This has important implications for the potential and actual increase in employment.

It is commonly asserted that in the absence of modern technology employment would have expanded faster. In relation to banking, where conventional methods of operation were largely labour intensive, it appears logical to hypothesize that a fourfold increase in operations would have generated a proportionate increase in employment. But, such an assertion would have been based on the doubtful premise that such an increase in operations would have been possible even in the absence of the new technology.

Technology reduces the labour-output ratio, but by increasing output substantially beyond the level that would have been possible in its absence, employment may in reality increase more than it would have increased under conventional methods of operation. Between 1965 and 1975 the total domestic employment of banks increased from 75,728 to 123,567 or by 63 percent.

Table 1

Employment of Chartered Banks in Canada, 1964-75

January 31

Year	Men	Women	Total	Percent Increase
1964	31,286	42,695	73,981	-
1965	31,234	44,494	75,728	2.4
1966	30,744	46,733	77,477	2.3
1967	30,005	49,356	79,361	2.4
1968	29,846	53,075	82,921	4.5
1969	30,025	56,455	86,480	4.3
1970	30,546	61,051	91,597	5.9
1971	30,031	62,980	93,011	1.5
1972	29,739	65,745	95,484	2.7
1973	31,143	72,101	103,244	8.1
1974	33,168	79,974	113,142	9.6
1975	34,806	88,761	123,567	9.2

Source: CBA

It is noteworthy that 43 percent of the increase in employment over the 1965-1975 decade was recorded in the years 1973-1975: the rate of increase in those three years averaged 9 percent per year, whereas prior to 1973 it averaged only 3.3 percent per year.

This acceleration in the rate of increase in employment coincides with the period during which a number of the chartered banks were in the process of installing their computer-communications systems. Hence, the increase should be viewed as transitory and accommodative: in the period of transition from largely manual to largely electronic processing, relatively large numbers of technical and operational personnel had to be taken into employment; secondly, it is conceivable that for a period after the introduction of the systems, operational problems prevented their efficient utilization, necessitating the continuing employment of personnel

for manual operations; thirdly, while the new systems were being set-up banking operations continued to expand at the relatively rapid rate of the early 1970's, requiring additional personnel; and fourthly, although the new technology facilitated a substantial increase in the volume of information processed per employee, the volume of information itself may have grown faster than the rate of increase in efficiency.

The rate of increase in employment is expected to decelerate as the computer-communications systems become progressively more integrated. Regional and national integration of "on-line" systems will speed-up data transmission, will make access to information instantaneous in all parts of each system, and will reduce the volume of paper float. The elimination or significant reduction in the volume of paper float means, of course, the elimination of most employment functional activities that involve paper processing. This is the premise on which a deceleration in the rate of employment increase is expected.

But, forecasters may be proven wrong: the elimination of a functional activity does not always mean the elimination of an employment position; it may well mean the substitution of one set of functional activities for another. In the case under examination, there will be considerable substitution of paper processing functional activities with activities that relate to the preparation of information inputs for the system, and the examination ("proofing") of system outputs. On balance, it is difficult to make a categorical statement about the ultimate level of employment in so-called "routine" low-skilled positions. Although it is quite likely that substitute systems related activities will be created, it is unlikley that routine low-skilled employment positions will increase at the rate experienced over the recent past.

While there is some uncertainty about the ultimate level of employment in low-skilled positions, there is no uncertainty about employment in high-level positions: computers retain into storage information that is deposited into them, and release information on demand in whatever forms they are instructed to release it; furthermore, while computers can release information in minute detail and configuration, they must be instructed on the nature of detail and configuration appropriate for individual decisions. For such, and many other related functions, increasing numbers of high level manpower will be required. The specialization of such high level manpower would be of an analytical nature, not narrowly technical: individuals broadly knowledgeable of the economy, society, industry and finance will be needed, to examine, analyse and design the available information into forms appropriate for the ends to which it is intended.

In summary, increasing utilization of electronic data processing equipment in banking operations will affect employment in the following ways: (1) total employment will continue to increase, but at a substantially lower rate than that recorded over the past decade; (2) the introduction of "on-line" transmission of data, and automatic recording and adjustment of deposits, withdrawals, charges, sorting and other routine functions will cause a decrease in employment in occupational classifications whose main functional activity is paper processing; (3) the effective and efficient utilization of the costly electronic networks will require high level personnel with broad knowledge of the technology and its potential, as well as of the economy, society and finance. The design and analysis of information inputs and outputs will be the core activity of such personnel; (4) substantial increase in employment

can be anticipated in classifications associated with the use of equipment, such as encoders, programmers, data control clerks, reader-sorter operators, and a score of supervisory personnel. This pattern of employment adjustments is likely to take place regardless whether banks limit the range of their service activities to those which they now perform, or expand into additional activities.

Employment Related to the Use of Electronic Systems

Employment related to the use of electronic systems has been commonly underestimated in magnitude and misestimated in occupational composition. Most enterprises and institutions using electronic systems have found it necessary, within relatively short periods after commencement of operations, to employ many more systems related personnel than originally estimated. In all instances brought to our attention, such unplanned additons to personnel were attributed to two main variables: (a) inadequate knowledge on the part of management regarding what "automatic" equipment can do, and (b) the dynamic nature of electronic systems, which is manifested in continuous improvements in technology and software.

Inadequate knowlege about the nature and potential of electronic systems has led many to the erroneous conclusion that the system will perform scores of activities at the push of a button. But, experience increases knowledge and knowledge exposes faulty assumptions. The push of a button will, indeed, cause information to be produced rapidly, but the usefulness of the information for decision-making purposes will depend on the nature of information deposited in the system, the design in which the information is sought, and the interpretation given to the

information that is produced. All these qualifications mean that the effective and efficient use of modern electronic equipment requires the employment of scores of specialized personnel. In addition to the well known occupations of programmer, computer operator and key entry operator, there have emerged the employment classifications of encoders, tape librarians, workstation employees, data control clerks, and a hierarchy of relatively high priced employment classifications, such as data processing managers, project team leaders, systems analysts and programmers (supervisor, lead, senior and junior classifications), computer systems analysts (various levels), and data communications managers.

Another efficiency related issue concerns the integration of the electronic systems network into the operations of the enterprise. Many enterprises appear to be using their systems as adjuncts to their operations. For example, when we asked a bank what were the employment effects of the electronic data processing system, we received in response information and opinion on all of the effects on employment related to the traditional operations of the bank, i.e. the effects on activities and numbers of tellers, accountants branch managers, supervisors, inspectors, senior decision-makers, but no information at all on employment at the data centre. Subsequent enquiries on the matter revealed that the centre was viewed as something separate, an invisible organization somewhere out there, which receives all the information that is relayed to it and gives out information that is instructed to give.

To the extent that this reflects physical distance from branch activities, it may not matter; but, to the extent that it reflects a

perception of the electronic system and its personnel as an operational system that is separate from banking activities, then problems of efficiency may arise. Systems personnel, especially those involved in information design and analysis, must be broadly knowledgeable of banking activities. They should be able to think the way operations officers do; and they should be able to anticipate the nature of information that will be required for the multitude of management decisions.

Effect on Branch Managers and Tellers

The two employment positions that have been most commonly associated with banking operations have been those of the Branch Manager and the teller. Indications are that both are being affected significantly by electronic data processing systems. As the day-to-day operations of branches are transmitted automatically to central, branch managers will no longer be required to prepare detailed financial reports on the operational state of the branch. Instead, their efforts will be directed increasingly to customer relations, the examination and analysis of causal factors that bear on the volume and nature of operational services, and the efficiency and effectiveness with which services are rendered. A change in managerial functions of this nature, will undoubtedly cause a change in the nature of educational qualifications and personal characteristics that will be required of candidates for such positions.

The extent to which managerial activities will actually change will depend, of course on the extent to which senior management will allow flexibility and diversity in operations amongst branches. Were senior management to opt for standardization in operations, which has been the traditional characteristic of risk-minimizing senior manage-

ment, then branch managers can be moulded into whatever shape tradition requires, and programmed to perform a set of specified standardized functions. In such cases, the educational qualifications and personal characteristics of candidates will be related to what is required for the successful moulding and programming of a standard branch manager. On the other hand, were senior management to opt for flexibility and diversity in operations, and were branch managers to be given considerable latitude in the nature and scope of operations, a different set of educational qualifications and personal characteristics would be required. The individuals involved would require knowledge that extends beyond the intricacies and mechanisms of banking operations; they would have to become knowledgeable of industry, social structure, the economy, government, business-government relations, and all other variable forces that bear on operations.

The basic functional activities performed by tellers, namely, the acceptance of deposits and the honouring of withdrawls, will continue to be performed by tellers for some time, but the performing process will change. As tellers' stations become linked to data processing centres, the activities performed by tellers will be automatically transmitted to the centre, and immediately following the transmission of a deposit or withdrawal a reverse transmission will take place from the centre to the teller's station indicating the resulting balance. The implications of this process for the teller can easily be deduced: (1) the manual recording of information on deposits and withdrawals will be eliminated; (2) to the extent that the functional activities of tellers involve the processing of information on deposits and withdrawals, that too, will be eliminated; (3) to the extent that

tellers' functions after "banking hours" are related to their manual functions during banking hours, the elimination of manual functions will eliminate the need for them after "banking hours". This suggests two possible changes that will effect tellers: (1) they will be required to be more knowledgeable of customers' accounts and provide information and some advice on demand. In the absence of "on-line" computer operations, tellers know only the balance of a chequeing account; this puts the onus on the customer to know or guess what cheques have been processed and what are still in transit. The "on-line" processing provides the teller and the customer with a detailed up-to-date statement on the state of the account in an instant. Are tellers sufficiently knowledgeable to cope with the additional information that will be presented to them instantaneously, and with the questions that customers will undoubtedly ask? (2) the elimination of "paper work" from the tellers' functions suggests the possibility of extending banking hours to a full day's work or employing part-time tellers to provide services during banking hours only. There is no evidence of a trend at present; there is some evidence of experimentation with alternative programmes.

TECHNOLOGICAL INNOVATION STUDIES PROGRAM

PROGRAMME DES ÉTUDES SUR LES INNOVATIONS TECHNIQUES

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1. Litvak, I.A. and Maule, C.J., Carleton University. **Canadian Entrepreneurship: A Study of Small Newly Established Firms.** (October 1971)

2. Crookell, H., University of Western Ontario. **The Transmission of Technology Across National Boundaries.** (February 1973)

3. Knight, R.M., University of Western Ontario. **A Study of Venture Capital Financing in Canada.** (June 1973)

4. Little, B., Cooper, R.G., More, R.A., University of Western Ontario. **The Assessment of Markets for the Development of New Industrial Products in Canada.** (December 1971)

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6. Mao, J.C.T., University of British Columbia. **Computer Assisted Cash Management in a Technology-Oriented Firm.** (March 1973)

7. Tomlinson, J.W.C., University of British Columbia. **Foreign Trade and Investment Decisions of Canadian Companies.** (March 1973)

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9. Litvak, I.A., Maule, C.J., Carleton University. **A Study of Successful Technical Entrepreneurs in Canada.** (December 1972)

10. Hecht, M.R., Siegel, J.P., University of Toronto. **A Study of Manufacturing Firms in Canada: With Special Emphasis on Small and Medium Sized Firms.** (December 1973)

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18. Robidoux, J., Université de Sherbrooke. **Analytical Study of Significant Traits Observed Among a Particular Group of Inventors in Quebec.** (August 1974) (Available in French)

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69. Peitchinis, S.G., University of Calgary. **Technological Changes in Banking and their Effects on Employment.** (January 1977)

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