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Currie, Coopers
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DEPARTMENT OF COMMUNICATIONS

AN ECONOMIC ANALYSIS OF THE CANADIAN SOFTWARE INDUSTRY

January 27, 1983

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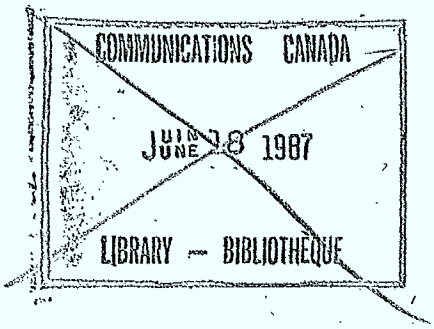


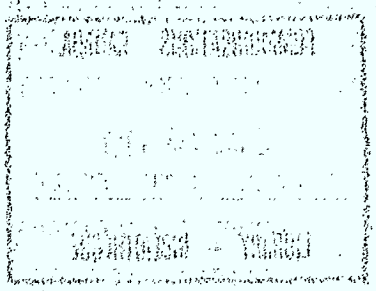
DEPARTMENT OF COMMUNICATIONS

AN ECONOMIC ANALYSIS OF THE CANADIAN SOFTWARE INDUSTRY

January 27, 1983

Submitted to: C. D. Le, Directeur
Division de l'analyse économique
Direction de l'économique des communications

Submitted by: A. J. Adams
E. M. Morrow



DEPARTMENT OF COMMUNICATIONS

TABLE OF CONTENTS

I. INTRODUCTION

We are pleased to submit this proposal in regard to Phase II of a study of the Canadian software industry in response to your request dated December 30, 1982 addressed to our Quebec associates, Drouin, Paquin & Associes Ltee.

As discussed at our meeting with Mr. F. S. Jones and Dr. P. K. Neogi of the Department of Communications in Ottawa on January 20, 1983, the field of study is extensive and complex, the data available is limited and the impact of the study likely to be significant. The available budget of $25,000 is clearly inadequate to fund the scope, the scale and the detail of research, of dialogue with the industry, and of reporting which full completion of the terms of reference would imply.

Nonetheless, even a limited study which is successful in identifying major opportunities, threats and constraints, in recommending broad strategies and policy initiatives, and in promoting the case for further study and discussion of the key issues, will have its value.

Because of our background in the industry and the strategic focus of our practice, we believe we are uniquely qualified to assist you in achieving the above results at a credible and useful level of definition. The value to us of our reputation in this regard provides assurance to support our commitment to put the effort in to achieve a worthwhile result, regardless of the budget constraint.

Successful achievement of this end will require flexibility and discipline on both sides of the contract in order to focus, adjust and manage the work programme throughout the study. We believe we can count on your cooperation and assistance in this regard.

In the next sections of this report, we set out our background and perspective on the software industry, our approach to the study, and other relevant details.

II. BACKGROUND, STAFF, EXPERIENCE AND PERSPECTIVE

Currie, Coopers & Lybrand, which includes Drouin, Paquin & Associes Ltee as its Quebec arm, is one of the oldest and largest Canadian management consulting firms. Informatics is a major component of the firm's practice and the Information Management Group represents about one third of the total professional staff. Of these, some 23 are qualified in the strategic planning area which is relevant to the current study. A list of these professionals is attached as Appendix I, together with the resumes of Mr. A. J. Adams and Mr. B. M. Morrow who will carry out the main part of the work. We also enclose the service profile of the Information Management Group for your information.

A. RELEVANT BACKGROUND AND EXPERIENCE

The Canadian software industry has been a particular focus of our Informatics planning practice for many years and Mr. A. J. Adams, senior partner and national director of that practice, has personally performed or directed many studies and projects which give him an intimate and current knowledge of that market from both the buyers' and the sellers' points of view.

This work has included:

- participation in benchmark Canadian designs and installations of advanced software, beginning with the Toronto Stock Exchange in 1962, development of the first portable construction industry system in 1969 and, more recently, with the implementation of the first on-line hydro electric power distribution and control system in 1981, among many others.

- selection, acquisition and implementation of proprietary software on behalf of many clients, including commercial data centres as part of their service offering. Types of software involved have included:
  - applications software for many industries and governments
  - problem specific languages such as GPSS, SIMSCRIPT, APT, EMPIRE and so on,
  - data base management systems
  - modelling and financial packages
  - performance monitors and resource management and billing software
  - operating systems
  - high level languages
  - special purpose software of various kinds, including programming aids and end-user support tools
- evaluation of the market for software, nationally and internationally, on behalf of Canadian suppliers, foreign suppliers, government bodies and several Canadian financial institutions either involved, or considering investment, in the marketplace. Several studies have been completed for American suppliers considering entry to the Canadian marketplace.
- work completed during the last two years has included:
  - a comprehensive review of international package software trends as part of a strategic study on behalf of the Republic of Ireland headed by Mr. A. J. Adams. A particular focus of this study was on government policy in regard to the encouragement of software as well as other components of the informatics industry
  - a review of the complete product line, marketing arrangements, competitive position and forecast sales of a major Canadian software supplier in regard to the

Canadian and U. S. markets on behalf of the board and a major financial institution. This was completed in November 1982.

In addition to the specific professional work noted above, Mr. Adams has been an active contributor to the general development of the software and informatics industry through personal participation in activities such as:

- CCTF committees
- C.S.A. software standards committee
- vice-chairman of the board of H.M.R.I., the largest Canadian developed health care data base
- board member of UTLAS, the dominant Canadian supplier of on-line library cataloguing systems
- national executive of C.I.P.S. and immediate past chairman of the publications committee responsible for the Computer Census and the Software Directory.

He is also an active teacher, writer and lecturer on the subject of software design, development and selection, and is on the curriculum advisory boards of Sheridan and Ryerson Colleges.

Mr. Morrow has worked with Mr. Adams on assignments relevant to the above, has extensive experience prior to consulting with a major software business, and has provided leadership and direction to strategic studies and office automation projects in the Ottawa Office where he is a manager.

Mr. Adams will carry out the major work involved in this study assisted by Mr. Morrow. Their resumes are included in Appendix I.

B. BRIEF PERSPECTIVE ON THE SOFTWARE INDUSTRY

Based on the experience noted above, we summarize below some key characteristics which may provide a useful perspective on the history, current status and future prospects of the Canadian software industry.

1. A Disorderly Marketplace

Software products of significant scope and renown on a national and international basis have been or are being produced across Canada by many organizations whose primary endeavour is not connected with the production of software to market. Universities, oil companies, construction companies, financial institutions, government bodies, health care institutions and libraries are among the organizations which have marketed, sold, traded or given away substantial software which might otherwise have become a portion of the revenue or reputation base of the software industry. This practice has also had its impact on the pricing, support arrangements, reliability and quality of the software available to the market which has not always been beneficial to the dedicated software supplier.

Manufacturers and suppliers of computer and communications equipment dominate certain areas of the market, in operating systems for example, and are a major force in data base management and a wide range of more general applications software. At the same time, especially in the mini computer field, they have been excellent customers of the software industry and have involved them in the sale of equipment and turn-key systems.

The complexity and impact of the multi-dimensional and conflicting relationships with the equipment vendors is a significant factor for the software supplier and affects dimensions of his business beyond thoseof marketing, including competition for human resources and capital.

Buyer resistance to pre-packaged software and the use of contract programming services has been significant, partly due to the impact on internal employment and status and partly due to a very reasonable suspicion about product quality and support and the financial viability of the vendor. In this latter regard, the software vendor is often at a disadvantage in relation to the other competitors in the marketplace, including American based software vendors who are often larger, equipped with an impressive reference base and sponsored by a large corporation such as McDonnell Douglas, Boeing or General Electric.

Buyer resistance for internal employment reasons may increase in foreign markets if recent European union settlements become a trend. These give internal unions the right to rule on software acquisitions by their employer.

The buyer and the seller share a common problem which is significant to both. This stems from a lack of generally accepted standards and practices which would define:

- software evaluation procedures
- software tendering and procurement procedures
- software contracting practices
- software maintenance rights
- software portability

In effect, software is often difficult to define, compare, select, buy, manage and control. Selling and buying software are thus made unnecessarily complex and risky for both sides to their mutual disadvantage. The dependence of software on hardware, telecommunications and other software products which are also light on standards, compounds the problem.

The disorder in this growing marketplace is continually being amplified by:

- technology shifts which are expanding existing markets, opening up new markets among smaller users for scaled down versions of existing products, and creating new markets in the areas of office automation, personal computing, end-user programming and decision support systems
- increasing variety in the methods of developing, marketing and distributing software products and in the competitors who are directly or indirectly in the marketplace
- increasing variety in the products themselves
- severe competition for truly able human resources
- significant and growing shortage of timely, useful and reliable information on which to base marketing, product development, investment and human resource decisions.

Given the direct and indirect competition in the marketplace and the vested and substantial interests which support that competition, it is reasonable to ask whether a vigorous and competitive software industry can in fact be developed and maintained at a size where it can make a significant contribution to the internal and external economic performance of Canada.

Based on the experience of foreign jurisdictions, primarily in the U. S., the U. K., and France, the answer appears to be that it can. Based on Canada's needs and limitations in regard to the overall informatics marketplace, the answer should be that it must: if Canada is not to lose its reasonable share of this fundamentally important market. Because of the interdependence of the software supplier on other market forces, any initiative to encourage software development must take account of these forces and of related initiatives to be fully effective.

2. The Canadian Software Industry

The perspective above is not unique to the Canadian industry but is amplified in Canada by the dominance of foreign equipment suppliers and by the relatively small scale of the industry and of its member firms. The latter limits the ability of the industry to support research and development and to acquire the broad based "critical mass" of human resources on which effective product development must rely.

In Canada, there is a very large number of small firms, academic entrepreneurs, and businesses who have more or less inadvertently become software suppliers. There is also a very much smaller number of larger firms, employing 100 or more professionals, who offer services which include:

- custom software and programming services
- proprietary software
- software-based turn-key systems (i.e., including hardware)
- computer and/or information based services in which software is a key component of the service, e.g., Alphatext, F.R.I., Sharp, Info Globe, Infomart, U.T.L.A.S., as well as major computer service bureaus such as Data Crown, C.S.G., Dataline and others.

It might also be wise, in considering the industrial potential of the Canadian software industry, to include firms such as G.E.A.C., which have a unique combination of hardware and software excellence, and firms such as A.E.S., NELMA and so on where software is a key component of the delivered word processor or micro.

Even thus broadly defined, the software industry in Canada is small in relation to total informatics employment, between 5 - 10% of all informatics jobs, and with few exceptions, is only partially dedicated to the development of proprietary software. Most large firms rely heavily on revenues from other services or products to fund their proprietary products. The reputation enjoyed by some of these firms on the national and international scene is often based on other grounds. These can, of course, be useful in providing market access and credibility for software products.

The small number of large firms in the industry appears to have based its initial entry to the applications package market on what were originally custom systems for particular market sectors such as health care, manufacturing, and distribution, or particular generic functions such as information retrieval, graphics, word processing and so on. While some excellent results have been obtained, this has been far from universal and particular difficulties have been evident in marketing, selling and supporting reliable software products. These difficulties have meant in turn severe financial problems for some important members of the group.

On balance, we believe the major difficulties encountered by the industry have not been technical. Canada has produced too many world class systems over the last two decades for this to be credible. Instead, we think the problems have resulted from failure to perceive, and to acquire the resources to deal effectively with, the challenges of:

- marketing
- designing to market
- selling and supporting "standard" products
- financial planning and control
- human resource management
- co-ordinating product lines
- acquiring capital
- balancing the emphasis on technocracy with marketing and business management needs
- forming appropriate industrial partnership, sponsorship, and/or investment arrangements.

All of the above difficulties have been solved at one time or another by some members of the industry, certainly some of the leaders. What is lacking overall is consistent attention to the above issues, clear market focus, and careful attention to sound business management. Given the complexity and inter-dependence of the industry, these factors have particular importance.

In concluding this brief perspective on the software market and the Canadian software industry, it will have become evident that the field is complex in an economic as well as a technical sense and that the software industry faces peculiar difficulties and constraints in finding appropriate market niches, competing with its direct and indirect competitors and in focussing and balancing its

efforts between the production and marketing of software. These difficulties are amplified by a general lack of reliable and current market information, by competition for scarce human resources and by problems in obtaining capital for marketing as well as software development needs. The field demands excellence in entrepreneurial leadership and solid business management, as well as in technology. This management shortage may be the most critical limiting factor of all.

In the next section of this report, we propose an approach to the study which will capitalize on the experience of the assigned professionals and the perspective on the software industry which is noted above.

III. APPROACH TO THE STUDY

In this section we set out general considerations governing our approach to the study, the preliminary work which can begin on or before March 1, 1983 and the remaining work required to complete the terms of reference by the end of September 1983.

A. GENERAL CONSIDERATIONS

It is a requirement that the study begin by March 1, 1983 before the full results of the quantitative study in Phase I are expected to be available. This poses no difficulty as there is considerable useful preparatory work which can be undertaken in advance of the data.

We also expect to capitalize on this to some degree, by reviewing and possibly obtaining any useful modifications to the data content, format and timing which will improve the value of the study as a whole. We hope also to expand our understanding of

any data limitations which may be anticipated by the Phase I supplier, so that we may adjust our approach to compensate for these. In particular, we are concerned, as noted in Section II. B., that because the software supplier, in Canada and elsewhere, is only one actor in a complex market that judgments based purely on existing supplier sales and forecasts may be misleading.

We will also review with the Phase I supplier a list of industry experts and leaders who may be contacted for participation in the study by interview, questionnaire or panel discussion. This will confirm the degree of coverage which will be needed to derive and/or validate survey findings.

This latter point implies a focus, which is determined by budget and other practical considerations, on the currently dominant members of the industry as defined in Section II above. While this is important, some attention must be paid to smaller members of the industry, some of whom may be the future leaders. (On three occasions recently, we have selected suppliers employing less than 50 professionals against strong national and international competition from very large firms.) In addition, the study cannot safely ignore indirect competitors, whether inadvertent or deliberate, nor can buyer attitudes and expectations go without attention.

These latter populations at interest can most effectively be reached by some combination of mail and professional or trade magazine survey. Subject to cost constraints and any reservations you may have about the publicity aspects of this idea, we plan to do this. Survey content will be an organized subset of the information noted below arranged to minimize respondent effort,

ambiguous responses and analysis time. We have already confirmed the willingness of CIPS in principle to participate in this effort and may seek some assistance from the Phase I supplier and/or the Department of Communications in providing the appropriate "number crunching" support if we mutually agree to proceed with this innovative and practical idea.

B. PRELIMINARY WORK

Depending on when agreement to proceed is received, some or all of the following preliminary work can begin on or before March 1, 1983.

1. Meeting with Department of Communications to review and adjust this proposed approach. We note that Transportation & Communications, Ontario, may also be involved and suggest you may find it useful to refer to the Deputy Minister, Mr. H. F. Gilbert, or the Assistant Deputy Minister, Mr. Mark Larratt-Smith to validate our standing in that Ministry.
2. Meeting with the Phase I supplier with the objects already noted in Section III, A. above.
3. Development of an initial schema for organizing and classifying data and opinions arising from the study to facilitate:
   - structured interviews,
   - survey design,
   - recommendation testing, and
   - report development.

The components of this schema at the current time seem likely to include:

- development of an initial classification scheme for software products by:
  - function
  - market(s)
  - distribution practices and options
  - equipment dependency
  - competitive environment
  - development source(s), and so on.
- initial assessment of the critical success factors required for:
  - developing,
  - marketing,
  - supporting, and
  - managing

  the major software groupings identified above.
- initial assessment of the infra-structure elements required to assist the industry meet these critical requirements in the short, intermediate and longer term, e.g.,
  - access to capital
  - access to human resources
  - access to markets
  - access to industry and competitive data
  - access to management and marketing skills
  - government assistance
  - tariff protection and so on.
- draft identification of the major strategic options which might be pursued by the industry and by governments in meeting the infra-structure and the critical success factor needs.

The output from this key step will be documented in draft form for review with the department before use in the following steps. It will be important at this point to decide whether to proceed further or to await the Phase I data before proceeding to the next steps. We think there are advantages and disadvantages to either course which can be judged more effectively when this stage has been reached.

C. COMPLETION OF THE STUDY

1. Whether with or without some incorporation of the Phase I data, the draft document can now be used as the basis for preliminary discussions with the leaders of the industry, with experts from related fields and with government agencies as required and agreed. These discussions could embrace the following main topics:

- Does the classification scheme embrace the major software markets and characteristics?
- How should these market areas be ranked now and in the future in terms of:
  - size
  - ease of entry
  - competition, and Canadian position,
  - capital required and so on?
- How should the critical success factors be ranked, now and in the future: where is Canada strongest and weakest?
- What are the current strengths, weaknesses and constraints in the infra-structure in Canada? How can this be improved?
- What major strategies offer the best hope of developing a significant international capability by the industry?
- what major trends and developments will influence these most?

- What key indicators should be used to adjust and modify these strategies during implementation?

2. Similarly, a brief, pointed survey instrument can be designed and issued to elicit the views of the more widely distributed populations at interest. This must be available by April 14 to meet the CIPS REVIEW deadlines for their May/June issue for example. In order to reinforce responses, we plan to use our national office network to solicit responses from important local firms or authorities. CIPS local branches may also be willing to assist in this way.
3. Assemble, analyze, summarize and interpret information from all sources and draft preliminary findings and recommendations.
4. Summarize and present findings for review and discussion at an industry panel.
5. Adjust, finalize and submit report to the Department of Communications.

D. ESTIMATED FULL WORK CONTENT, TIMING AND COSTS

The scope, coverage and approach to the study will be adjusted progressively by agreement as the findings dictate. In addition, the degree of response and the quantity of data and analytical effort required remain speculative at this point as does the degree of commitment and willingness of the industry and its related participants to contribute some time and effort. With these cautions, we have estimated the probable work content, timing and costs as follows.

ESTIMATED FULL WORK CONTENT, TIMING AND COSTS

	PROFESSIONAL TIME (HOURS)			END
	ADAMS	MORROW	TOTAL	DATE
Preliminary work (B 1, 2, 3 above)	60.0	10.0	70.0	3-31-83
Completion of Study				
C. 1 (based on 20 interviews, and including summarization of findings)	80.0	-	80.0	7-31-83
C. 2 - Survey design & publication	8.0	30.0	38.0	4-14-83
- Administration of survey responses, analysis of reporting based on 200 responses and assumed collection and summarization by others	8.0	30.0	38.0	7-31-83
C. 3 Develop recommendations and draft report	80.0	20.0	100.0	8-15-83
C. 4 Industry panel review	16.0	8.0	24.0	8-30-83
C. 5 Final report	30.0	2.0	32.0	9-30-83
TOTALS	282.0	100.0	382.0	
At normal government fee rates of $125/hr. for Adams and $105/hr. for Morrow Fee costs are	$35,250	$10,500	$45,750	

The above time and fee estimates represent the rock bottom minimum level of effort required to address the study terms of reference with a reasonable degree of depth and with what we believe to be adequately wide coverage of the market. In addition, it makes no allowance for the use of our branch professional staff in stimulating survey responses nor does it provide for out of pocket costs which will be at least $5,000.00 in travel and report preparation. Our total minimum fee and expense estimate would therefore be:

Total Above Fees	$45,750.00
Branch Fees (80 hours)	8,000.00
Total Fees	$53,750.00
Out of Pocket Costs	5,000.00
Total Costs	$58,750.00

Realistically, allowing 20% contingency, the required study budget ought to be in the area of $70,000.00 instead of the available $25,000.00. This does not allow for the "number crunching" of survey data which has been assumed to be allocated to others.

We put this before you so that you have the benefit of our opinion in regard to the minimum scope and the minimum cost of a reasonably comprehensive and credible study of the complex and important software industry.

E. SCALING THE STUDY CLOSER TO BUDGET

A fully detailed and supported study clearly cannot be done for the available budget in spite of the greatest ingenuity and economy of approach. We would propose therefore that you give consideration to limiting the scope of the study vertically and horizontally in some of the following ways:

- Hold activity B. 3 until the Evans data is available and tightly focus the remaining study effort on the main market trends, and suppliers indicated by that data.
- Eliminate the interview process (C. 1) and the mail/magazine survey process (C. 2) and substitute a single mail survey with telephone follow-up, addressed to 20 major suppliers, 20 major buyers and 10 smaller software firms.
- Produce and circulate a draft summary report for written response by a selected subset of volunteers from among the above 50 survey respondents.
- Incorporate findings and debrief with the industry panel already noted.
- Develop report as indicated but severely limit the time and effort devoted to item (v) in your schedule of tasks on Page 2 of the Statement of Work. This does not mean these issues would not be identified and prioritized, merely that they would not be explored, analyzed and documented in detail.

The estimated impact of this scaling down would be to reduce the professional work requirement and associated fee costs approximately as follows:

- Item B. 1, 2, 3 - no effect except on timing
- Item C. 1, C. 2 - eliminate - Adams 96.0
  - Morrow 60.0
  - branches 80.0
  - Total 236.0 hours
- Substitute survey and add - Adams 30.0
  Report circulation activities - Morrow 30.0
  60.0 hours
- Limitation on item (v) on page 2 Adams 20.0
  of Statement of Work Morrow 10.0
  30.0 hours

Net total reduction in hours and fees	Adams	86.0 hours	$10,750
	Morrow	40.0	4,200
	Branches	80.0	8,000
	Totals	206.0 hours	$22,950

Thoroughly scaled down as indicated, the minimum possible study budget thus can be summarized as follows:

Fees	Adams	$24,500
	Morrow	6,300
Out of pocket costs		5,000
Total		$35,800

No difficulty is expected in meeting the timing constraints under either approach.

The risk in scaling the study effort down so dramatically should be obvious. At the same time, we believe that significant and credible results can be obtained for this level of effort even if these are much more limited than we both would want to see in the long run.

With this in mind, we are willing to commit the above level of effort and time at a cost to you which will not exceed the budget limit of $25,000.00. Note also that we will be obliged to control our own investment within the limits noted above and will be watchful to assure the quality of work which will be needed to justify that investment.

IV. CONCLUSION

We have presented in this proposal an approach to the conduct of a study of the software industry based on our understanding and experience. In

spite of bringing all our ingenuity to bear, we have not been able to design a study which fully addresses the terms of reference within the budget constraint of $25,000.00.

In order that you may perceive what may be lost by compromise in this regard, we have documented and estimated the minimum study which can address the full terms of reference and the full width of the market.

Against that context, we have suggested how a more limited but still useful study may be completed for a normal fee and expense arrangement which costs out at $35,800.00.

To show our interest and commitment to the software industry and to this study, we have offered to complete the more limited version at a total fixed cost to you of $25,000.00.

We look forward to working with you on this challenging project.

CURRIE, COOPERS & LYBRAND

Currie, Coopers & Lybrand

PARTIAL LIST OF PROFESSIONALS

WITH STRATEGIC PLANNING EXPERTISE

AND THE RESUMES OF:

A. J. ADAMS

B. M. MORROW

INFORMATION MANAGEMENT GROUP

PARTIAL LIST OF PROFESSIONALS

WITH STRATEGIC PLANNING EXPERTISE

A. J. Adams, Senior Partner and National Director

EASTERN REGION (HALIFAX, QUEBEC, MONTREAL, OTTAWA)

W. J. Gallop, Partner
J. P. Herzog, Partner
J. R. Truchon, Principal
G. Delorme, Manager
G. A. Neufeld, Manager
B. M. Morrow, Manager
B. A. Sabean, Manager

CENTRAL REGION (TORONTO, WINNIPEG)

R. D. Hossack, Partner
G. A. Brown, Principal
T. J. Klich, Principal
L. H. Chapman, Manager
V. W. Fearon, Manager
M. L. Gleeson, Manager
I. S. Barber, Senior Consultant
A. Rice, Senior Consultant
S. R. Tudor, Senior Consultant

WESTERN REGION (VANCOUVER, CALGARY, EDMONTON)

W. Fellows, Partner
D. A. Louth, Principal
A. Brown, Manager
B. A. Jackowich, Senior Consultant
J. Mason, Senior Consultant
E. O. Wuolle, Senior Consultant

Professional Qualifications

Currie, Coopers & Lybrand

ALEXANDER J. ADAMS

BACKGROUND

Mr. Adams is the senior partner, management systems, for the firm. He became a partner in 1969, and the National Director of Management Systems in 1974. His career in computer/communications systems design began in 1954 with the Ford Motor Company, followed by several years with Univac and Ferranti before joining Currie, Coopers & Lybrand Ltd. in 1964.

His large-scale computer experience at Ford was continued at Univac and Ferranti where he provided systems design, programming, hardware/software selection, project management and other services to clients such as: Toronto Stock Exchange, Toronto Traffic Control, DeHavilland Aircraft, Orenda Engines, Ontario Hydro, Saskatchewan Power, T. Eaton Co., and Bell Canada. He was directly involved in several of the earliest applications of on-line computer technology and in the application of one of the first multi-programming processors.

He has been an active contributor to computer literature, having published more than thirty articles in the field, as well as four privately commissioned texts. He is an active member of several committees concerned with computer education, standards and Canadian national policy formulation. He has lectured at the universities of Toronto, Waterloo, York and Ryerson. Mr. Adams is a C.A. and a member of the Institute of Management Consultants of Ontario.

PROFESSIONAL ASSIGNMENTS

Advanced Project Management Assignments

Design, development, hardware/software selection and procurement, testing, implementation and post-implementation review have been performed or directed in complex, large-scale environments over the last several years. Particular expertise has been developed in the application of design, documentation, testing, project management and procurement standards to on-line and batch environments. Structured design, programming and testing methods have been applied using HIPO, psuedo-code and formal project control software such as PRIDE and SPECTRUM. Regression testing, simulation, benchmarks, sensitivity analysis and

performance measurement hardware and software monitors have been applied. Particular expertise has been developed in measuring and designing the human interface with such systems. The above expertise has also been applied in the review of major systems development projects at key stages to validate feasibility, asssess status or re-direct the project. Some clients served in this way include:

Sun Oil
Bank of Nova Scotia
National Trust
North York Hydro
Brewers Warehousing
Steetley Industries
Bramalea Ltd.
Canada Permanent Trust
Armbro Holdings Ltd.
Syncrude
Bank of Montreal
Montreal Trust
SkyLark Travel
Comstock International Ltd.
Inter City Gas Utilities Ltd.
Pitfield Mackay Ross
Armbro Holdings Ltd.
T. Eaton Co.
City of Thunder Bay
British Leyland Motors Canada Ltd.
Ministry of the Attorney General
Ministry of Health - Hospital Medical Records Institute
- Ontario Health Computer Centres
Workmen's Compensation Board of Ontario
Ontario Mortgage Corporation
Markel Financial Holdings Limited
Canadian Scholarship Trust Foundation
Ontario Paper/Quebec North Shore

Hardware/Software/ Services Procurement, Contracting, Evaluation

Most of the preceding assignments involve hardware/ software evaluation, performance measurement, procurement and contracting as part of a development project. In addition, many assignments have involved the assessment of overall hardware/software strategy for an organization as a whole as part of the basis for procurement, for enhancement of service levels, for the sale of hardware/ software services together or separately or as part of the consideration underlying a corporate merger or acquisition. These assignments often include a requirement for marketing, financial and general management as well as technical skills. Clients involved have included:

Bell Canada
Syncrude
Ontario Mortgage Corporation
Montreal Trust
Welbey Data Centres
Eaton/Bay Financial Services
Province of Ontario (5 assignments)
Southern Ontario Hospital Computer Centres
Systems Dimensions Ltd.
Sun Oil
Ontario Paper Company
SkyLark Holidays Ltd.
Computer Sharing Services
T. Eaton Co.

Package and Systems Procurement and Contracting

Courses, workshops and seminars have been developed and presented to clients with an interest in the procurement of software, programming and processing services as an alternative or a supplement to internal resources. Clients served in this way have included:

Ontario Hydro	Quebec Hydro
CIPS	Industrial Development Bank
ASM	Ministry of Education (Ont)
Consumers Computer	
Department of Supply and Services (Canada)	
Management Board of Cabinet - Ontario	

Organization, Staffing, Planning, Development, Management and Performance of the EDP Function

A number of reviews have been conducted of the overall EDP function and long range plans have been developed to improve the performance, management, staffing and control of the EDP function by the organization concerned. Clients assisted in this way have included:

Systems Dimensions Ltd.	Management Board of Cabinet (Ont)
Bell Canada	Pilkington Bros. Ltd.
North York Hydro	City of Edmonton
Ontario Hydro	City of Thunder Bay
Syncrude Canada	Sun Oil
Ontario Paper Company	Ottawa-Carleton Transport
Hospital Medical Records Institute	
The Office of the Public Trustee (Ont)	
Workmen's Compensation Board of Ontario	
Comstock International Ltd.	
Central Computer Services (Province of Ontario)	

Special Studies

A number of special studies have been conducted over the years for a variety of clients concerned with the marketing of computer hardware and/or software, the performance of particular devices, software or suppliers, the underwriting, financing or acquisition of companies engaged in computer hardware or service supply. Briefs have also been prepared to the Computer Communications Secretariat, to the Ministry of Justice and to the Ministry of Finance in regard to national policy issues in connection with the computer communications field. Clients served in this way have included:

Systems Dimensions Ltd.	Canadian General Electric
Montreal Trust	Province of Ontario
Walwyn, Stodgell	Dominion Securities
Research Securities of Canada	Dataline Systems Inc.
Communications Research Council	
Canadian Institute of Chartered Accountants	

PRIOR EXPERIENCE

For Ferranti-Packard Computer Division, Sales Support Manager, responsible for the development, training and supervision of a team of systems analysts, programmers and engineers. Key installations were Toronto Stock Exchange and Saskatchewan Power.

For Univac, National Applications Specialist, responsible for providing technical support to the branch sales activities. Key installations included Toronto Traffic Control.

For Remington Rand, Controller, directly responsible for about 100 staff and functional responsibility for about 150 staff engaged in accounting control systems and reporting services for six product divisions operating out of 32 branches and five plants.

Conducted a special study for the President on the effectiveness of the branch and plant operations of the office equipment and business machines divisions which led these divisions to change over into a more profitable dealership organization.

For Ford Motor Company, Systems Analyst, involved in the application of data processing to purchasing, ordering, production scheduling, cost accounting and freight control.

PROFESSIONAL AFFILIATIONS

Institute of Management Consultants of Ontario
Canadian Information Processing Society, member and past director
Canadian Standards Association Committee of Computer Systems Standards, past member on committees associated with Systems Definitions Standards and Programming Standards
Canadian Institute of Chartered Accountants, past chairman and current member of Federal Legislation Task Group on Computers
Ontario Institute of Chartered Accountants, Management Consulting Committee member
Sheridan College Computer Education Advisory Council member
Ryerson Polytechnical Institute, Advisory Committee member
Canadian Organization for Advancement of Computers in Health (COACH), current member
Hospital Medical Records Institute (HMRI), Charter Member, Director, Executive Committee member, Vice-Chairman of the Board

PUBLICATIONS

Technical and managerial articles published by all major professional journals and frequently quoted in Financial Post, Daily Commercial News, Globe & Mail and other less technical publications.

Author of four major course manuals commissioned by institutional clients on project management/PERT, data processing technology, construction applications development and fixed price contracting for computer systems services.

Author of briefs on computer communications policy, electronic funds transfer, general policy initiatives.

SEMINARS

Lectured on EDP subjects for York, Waterloo and Toronto universities and at professional conferences.

ADAMS, A.J.
--An economic analysis of the Canadian software industry