The Impact of Telecommunications on the Environment: A Discussion Paper

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PREAMBLE

Every day, millions of Canadians across the country leave their home to go to work. Slowly and painfully, this human tide makes its way to its destination by various means such as mass-transit systems, aboard personal motor vehicles, bicycles or on foot. In the process, these individuals face countless obstacles, the most important ones being traffic congestion and smog. While the thought of driving to work at a slower pace in a comfortable vehicle, listening to your favourite radio personality and music or reading the last best-seller on the bus, commuter train or subway may seem attractive when it is sunny and warm, the perspective changes completely on an ice covered highway with potential uncontrollable cars and trucks on all sides. For most Canadians, winter is the most dreaded of all commuting time. For at least four months a year, commuters must face heavy snow precipitations varying from one to ten centimetres or even more, impatient or careless drivers and the unrelenting fear of being rammed by an out of control tractor-trailer or other automobile, in chain-like reactions. Snowfall, be it light or heavy, slows down traffic, makes roads slippery and in some cases can cause serious traffic accidents resulting in injuries and sometimes deaths.

Commuting also takes a heavy toll in the highway construction and maintenance budgets. In order for workers to get to their workplace and back home safely, provincial, municipal and regional governments must put into place an expensive and complicated infrastructure, whose responsibility it is to constantly monitor emerging residential communities, plan, build and maintain an important road network at considerable cost to serve the population's needs.

While this planning is actually taking place, discussions are under way between land owners and different levels of government, private citizens or interest groups, to identify or object to the acquisition of precious real estate enabling the unrestricted flow of commuters downtown, on a daily basis or prevent smooth flow of traffic by having street closed. Generally speaking, employment has always been linked with a geographical location. Examples do not abound of employees actually choosing to perform the tasks expected of them by their employers, without necessarily having to leave home. For this reason and because of the growing change of values by a number of employees who have decided to put family obligations at the top of their priorities or must relocate after a spouse's transfer, management in recent times has been faced with the prospect of losing workers with extremely valuable skills, not to better paying jobs, but to ones which offer more flexible working hours or enable the employees to work from their home. Finally, comes the opportunity for persons with disabilities but useful skills, to become actively involved in the workforce.

This paper examines ways telecommunications can provide serious alternatives to the present work scenarios and, more importantly, looks at the telecommuting issue as a significant and viable option to the use of regular transportation methods.

CANADA'S RELIANCE ON NON-RENEWABLE ENERGY

While Canada is an important oil and natural-gas producer and is actually self-sufficient in terms of automobile gasoline, it still imports part of these resources. Oil importation was approximately 2% between January and October 1991[1], to meet our country's domestic energy-consumption needs.

[1] Statistics Canada

What has become the main issue in the past decade, however, is not the scarcity of gas for the Canadian motorist, but rather the price he or she must pay at the pump. Gasoline prices vary according to market demand in Canada, with a few exceptions in provinces where price is regulated by special agencies. Federal and provincial taxes however, have brought up the price of this commodity to Canadian vehicle owners. During the 1980s, the price of gas in this country has increased 28 cents per litre, 60% of that amount being taxes. And even though gas prices in Canada were lower than in the United States in 1979, they had jumped by 60% in Canada by 1989, the largest gap of the decade.[2]

High gas prices have only slightly deterred motorists from using their personal vehicle to go to work. Even with the advent of more efficient mass-transit systems or special incentives to car-pool users in large cities, Canadians still prefer driving to the factory or office. Peak-hour traffic will give the casual observer an opportunity to witness large numbers of vehicles in which the driver remains the single occupant. The only silver lining in this story is the use of more fuel efficient and less polluting cars and trucks.

This daily traffic continues to have serious effects on the atmosphere and public health, not to mention the road network.

CANADA'S GREEN PLAN

As stated in Canada's Green Plan,[3] smog in our cities and polluted air in general have started to put a heavy burden on our environment.

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[2] **Énergie, Mines et Ressources Canada,** Étude de la décennie des années 80, Décembre 1989

[3] **Canada's Green Plan,** Government of Canada, 1990

On a global scale, we have recurring confirmation that our environmental situation is becoming worse and that future generations will be left with a terrible legacy of over-exploited non-renewable resources, polluted air and toxic wastes.

One of the Green Plan's assertions is that: "...Canadians can show the world what can be achieved by a people wanting to inhabit the world's most environmentally friendly nation."[4] In order for this national plan to succeed, government must set objectives which not only reflect the critical situation, but ones that are realistic and attainable. "To meet this challenge" the document continues, "the Government of Canada has defined specific goals. It is committed to working toward:

clean air, water and land;

sustainable use of renewable resources;

protection of our special spaces and species;

preserving the integrity of our North;

global environmental security;

environmentally responsible decision-making at all levels of society; and

minimizing the impacts of environmental emergencies."[5]

[4]Ibid. p.6

[5]Ibid. p.9

While the Green Plan has no pretention of being the solution to all of Canada's environmental problems, it recognizes governments' responsibility to provide leadership, society as a whole having to produce changes needed to meet economic and environmental challenges of the 1990s and beyond.[6]

Telecommunication technologies, for their part, can play a major role in helping Canada fulfil these objectives. We possess the resources and the will needed to succeed.

TRANSPORTATION COSTS

Governments spend billions of dollars annually to plan, build and maintain roads in Canada. Quebec for example, spent $1.6 billion in 1990-91 to build and maintain its 60,000 kilometre provincial road network. $14,500 were devoted to the construction and maintenance of each kilometre in that province.[7] The cost of a new 2-lane rural highway in Ontario, on the other hand, was $900,000 per kilometre in 1988, while the reconstruction price of an existing road came to $250,000 per kilometre.

Expenditures for a new four-lane highway during the same period would have been $3.5 million per kilometre in that same province, which has a total of 21,537 kilometres under the jurisdiction of the Ministry of Transport (MTO).[8] Maintenance expenses, is it any wonder, tends to escalate also with increased traffic on secondary or tertiary roads, where signs and traffic lights must be installed and maintained.

[6]Ibid. p.5

[7]Source:Transport Québec

[8]Source:MTO

Transportation engineers have been trying to address these issues but have only been partially successful by experimenting with electric, solar, natural gas, ethanol or methanol powered vehicles. Although this could only be termed as a gallant effort on the part of these individuals, one must not forget that most of the technologies involved in producing and using the so called "clean fuels" are still at the experimental stage, except for the natural-gas powered vehicles and these have only been operating in a limited number. Furthermore, research in this field only responds to portions of the issues, vehicles burning "clean fuels" continue to use existent or future road networks to get from one point to another.

TELECOMMUNICATIONS AND THE ENVIRONMENT

The analogy as often been made that, in Canada, telecommunications could be to the XXIst century what the railroad was in the XIXth century, a medium bringing Canadians together by abolishing vast distances and permitting faster communications.

One advantage telecommunications has over rail, however, is the amount of pollution produced by the former compared to rail. Furthermore, telecommunications practically do not require any use of non-renewable resources and is almost universally accessible to the Canadian population. Finally, telecommunications can address the "four Rs" needed to have and maintain a healthy environment: reduce, re-use, recycle and recover.

Telecommunication technologies help users maximize time and efforts while minimizing energy dependency. Critics will debate whether the use of fossil fuels is more damaging to the environment or socially acceptable than the building of electricity generating mega-projects.

Still, the point remains that communications technology is the way of the future and is closer to the present population-shared values, such as a shift in attitudes concerning the family unit, employees' quest for greater individual autonomy, self-fulfilment and quality of working life. According to a recent survey, Canadian office workers are generally not satisfied with their working conditions. Even though 84% of the workers say that a comfortable temperature at work is important, only 37% of them find these conditions at the office. 66% of them also estimate that it is essential to work in a calm and intimate environment but only 31% of the workforce have been able to find peace and quiet at the office.[9]

As an added benefit, energy used in telecommunications is produced in Canada and is renewable, thus eliminating any foreign dependency.

ADVANCED TELECOMMUNICATIONS

Canada's Department of Communications (DOC), has been actively involved in Vision 2000, a strategy involving Canadian government, industry and academia representatives. Vision 2000's technology should, according to its protagonists, enable the end-user to transmit voice, data or images, in other words communicating with, anyone at any given time, anywhere and by whatever means. And all this by the end of the century. Technology involved in Vision 2000 will actually make the most of what is presently available in facsimile transmission, cellular phone, satellite, video and other related communications technology. One of these technologies is the Personal Communication Number (PCN), a derivative of cellular communication which will have the same ubiquity as a social insurance number.

[9] La Presse, February 20, 1992

Under PCN, a phone number would no longer be associated with a geographical location but rather to an individual. If you have any type of communications device, it will have the same number. The third element of this service will be an intelligent controller, termed the Personal Agent. This will be a routing and tracking feature that will transfer communications to you independent of where your are.[10] We may witness, in the near future, the possibility of reaching subscribers with their individual communicating device, regardless of their location, one of Vision 2000's objectives. Such a technology is presently feasible. Representatives from industry and government are actively working at resolving some of the related issues to this new mode of communication such as incoming call invoicing, etc.

TELECOMMUTING OR THE "ELECTRONIC COTTAGE"

Author Reagan Mays Ramsower defines telecommuting as:"... the use of computers and telecommunications technologies which permits organizational employees to substitute telecommunications for transportation thereby permitting some or all of a job to be performed at a remote work site."[11] Other terms used for telecommuting are: remote work, home office work, telework, location-independent tasks and "home-distributed data processing".[12]

[10] Davies, G., **Getting Personal About Telecomm.** Canadian Datasystem, March 1992, p.19

[11] Ramsower, Reagan Mays, **Telecommuting: The Organizational and Behavioral Effects of Working at Home.** UMI Research Press, Ann Arbor, Michigan, 1989, p.2

[12] Cross, T. B., Raizman, M., **Telecommuting: The Future Technology of Work**. Dow-Jones-Irwin, 1986, p.4

Alvin Toffler had already predicted, in 1980, the advent of some form of telecommuting and the beginning of a new age when he wrote in his book The Third Wave: "Hidden inside our advance to a new production system is a potential for social change so breathtaking in scope that few among us have been willing to face its meaning. For we are about to revolutionize our homes as well."

US-based telecom consultant Rich Thoma, Chairperson of CommCon'91 said that telecommuting is no longer a scheme for the distant future. CommCon'91 was an exposition and conference devoted to new communication technologies available through public-access telephone systems, without leased lines. Experts agree that technology for working at home with complete access to business colleagues and databases is presently available and the pressures for it to be more widely implemented are increasing. California, which has the most stringent anti-pollution laws in the US, has already ordered companies to reduce commuting.

" New clean air regulations and the Middle Eastern oil crisis make telecommuting essential," according to Thoma.[13] Information can be transported more cheaply than people and industries are beginning to recognize the possibilities of the new economies. Telecommuting advocates estimate that within the next five years telecommuting could become widespread, approaching fifteen to twenty percent of the workforce.

Telecommuting is not indicated for all categories of jobs or workers however. It is most suitable to managerial, professional, and clerical levels involving, for example, various kinds of managers, information analysts, computer professionals, and information or word processing clerks.

[13]Link Network Letter, Nov.11, 1991

In the federal administration, Treasury Board, which has been monitoring some pilot projects, imposes strict guidelines to management and labour before agreeing to any form of telecommuting.

The telecommuter profile denotes a highly motivated and autonomous person, teamed-up to a goal-oriented organization.

TELECOMMUTING ADVANTAGES AND DRAWBACKS

We have already discussed a fair number of the advantages linked to telecommuting: cuts in commuting time, reduced pollution, reduction on the use of fossil fuels for vehicles, reduction of the wear and tear of the highway infrastructure, etc. These advantages are only a small portion of the ones with a direct impact on the environment. We could add to this list the ones which could have social implications, such as a greater reliance on the skills and talents of persons with disabilities or persons who only wish to continue to work on a part-time basis for family reasons. One last word finally pertaining to "flextime", in other words time where people feel they are most productive because they consider themselves either "morning" or "evening" persons. These terms are used to identify people who seem to feel best and are most proficient early in the day or those who work better after regular business hours, in other words, when it is convenient. Experts agree that telecommuting seems to improve the quality and increase the speed of an organization's communications and decision-making processes, enhancing its general overall productivity and reducing communications costs.

Research indicates that, although productivity among telecommuters often initially declines, it increases from 2 percent to 40 percent after the period of adjustment is over, providing an organizations with 20 to 300 percent worker-productivity increases, according to Jack Nilles of the University of Southern California.[14] Telecommuting will allow a marine biologist to easily carry his or her research in the field and be able at the same time to provide valuable advice to Ministers or senior managers. This scenario giving heed to those who have long favoured decentralization of the federal government services.

Among other benefits of telecommuting, organizations have found:

More diversified work accomplished

Opportunity to use underutilized but knowledgeable workers

Time saved in communicating. Using electronic mail in place of telephone calls is known to free about three hours for other office work each week

Improved morale among telecommuters and reduced occasional absences

Appearance, dress, and style of working go unobserved by supervisor and telecommuter

Elimination of interruptions and monitoring.

Telecommuting provides workers with a number of psychological benefits as well.

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[14]Ibid., p.9

Many people enjoy a sense of autonomy, perhaps the most important aspect of telecommuting, and consider it to be "a privilege, (and) an exercise in personal preference and commitment."[15]Workers also take satisfaction in helping to structure remote tasks, where given the chance, and achieve a balance between productivity and bottom-line responsibility. The department of Consumer and Corporate Affairs (CCAC), in August 1989, was facing a build-up of files, owing to the increased number of trade-mark filings. As a way to reduce the backlog, senior examiners were given an opportunity to take work home on an overtime basis. It soon became apparent that the home milieu had a beneficial effect on productivity as a result, in large part, of worker satisfaction. The department developed an experimental program that allowed much of the examination work to be done at home during regular work hours. The pilot project was simply called the "Work at Home" program or WAH. It turned out to be not only extremely successful in terms of production, but allowed CCAC to contribute to federal government experiments in human resources management. In fact this program is closely linked to a Treasury Board initiative to determine the feasibility of a policy that would allow public servants in all departments, under specific conditions, to work at home, or at other approved work locations. Workers comment the WAH program in the following terms:"I like the whole idea, especially the fact that I can escape from the nine-to-five routine. I'm free to work the way I want, taking advantage of my personal peak work hours... My life has become more streamlined and more 'one'. It's not so much my 'work-life' and 'home-life' any more. The two have come together." Some of the telecommuters admit that they miss the office to a certain extent. However, most say their social needs are easily met outside the office. The homers make periodic visits to the Trade-marks Office to deliver completed work and to pick up new work-cases.

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[15]Ibid., p.12

They also maintain close contact by attending regularly scheduled meetings with supervisors and managers in order to keep up to date on new practices and procedures essential to accurate decision making. The supervisors, for their part, also praise the WAH initiative. They are particularly pleased that stronger communications and a special closeness between the examiner and the supervisor have developed during the project. Under the program, the supervisors' responsibilities have increased. They are responding to problems over the phone from clients on behalf of the examiners, dealing with examiners' interviews and correspondence, and controlling or monitoring work distribution for two separate work environments. Their efforts free the examiners to concentrate strictly on the processing of applications and thereby virtually double their output. The Assistant Deputy Minister of Corporate Affairs and Legislative Policy Bureau, Morris Rosenberg, has called the WAH project a win-win idea. According to Mr. Rosenberg, the program enables the department to cope more effectively with increasing workload, while providing employees with greater control over both their home and work responsibilities.[16]

Telecommuters generally perceive a greater importance in one's position within the system. The exception is found among people in the military and female professionals who are concerned with office visibility, according to a Cornell University survey.[17]

Telecommuters also generally choose to be away from the office from two to four days a week. Because they are not physically present at the company or department, telecommuters require less office space or equipment at substantial savings to their organization.

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[16]**Work at Home**, Public Sector Management, Winter 1991, p.6-7

[17]Op.cit., p.12

It is less expensive to only provide a computer along with its peripherals to an employee than having to provide office space, heating or other services. These items could be negotiated in the initial telecommuting agreement, but employees will usually tend to forego these costs for the benefit of working at home and saving on clothing, commuting, etc.

This new approach could bring about the concept of shared office facilities where one telecommuter could use another telecommuter's office while he or she is away and vice versa. Telecommuting has a domino effect: fewer workers commuting means fewer vehicles on the road, thus less reliance on fossil fuels, fewer roads but in better shape, less pollution, less high-priced downtown space needed to build office buildings and thus more affordable housing for families.

On the other hand, researchers state that about one half of the companies that have had telecommuting programs abandoned them within two years. An assessment of failed programs show that it is usually the lack of standards and objectives in setting up projects that is at the heart of the problem. In addition, poor project management, inadequate programming standards and documentation for consultants, and a lack of communications between remote workers and the office are significant causes for failures when technology functions well and participants are carefully selected. Organizations that integrate remote-work programs sometimes run into the simple logistical problems of getting office and telecommuting personnel together for face-to-face meetings. Or remote workers may have difficulty in reaching a busy supervisor or other office personnel. In some instances, supervisors are uncomfortable handling remote, well-established work programs. It would seem that management, in this case, would fear losing control of employees and productivity rates and that remote work makes managing employees frustrating. Isolation is the primary psychological problem faced by telecommuters.

Documentation on the subject, suggests that telecommuters, as any group that is isolated for extended periods, need the stimulation of human interaction. John Naisbitt, co-author of "Megatrends" and "Megatrends 2000", emphasizes that the more people are forced to live with technology, the more they need human interaction. He continues by saying that there is little substitute for the stimulation, immediate feedback, and fun of direct contact in exchanging ideas. Naisbitt recommends that every organization that integrates a telecommuting program must determine the amount of time that is appropriate for each employee to spend handling remote-work programs. In addition, there is evidence that, in some cases, families of people who work remotely sometimes lack respect for the telecommuter and intrude into his or her privacy with demands.

Overeating and alcohol addiction can also be significant problems for the telecommuter who finds the refrigerator or liquor cabinet too inviting. Knowledge and limitations of local zoning ordinances is essential before venturing in any telecommuting program. Most of these by-laws were written to preserve the exclusive character of residential neighbourhoods and exclude occupations that create noise such as car repair, unsightliness such as advertising signs, odours (food preparation) et al. Corporations that decide to integrate telecommuting programs may eventually face a number of legal problems. One of them being that legal reference books, cases, or statutes that apply to telecommuting are practically nonexistent. Labour unions, for their part, have also expressed concern that management may exploit the unorganized telecommuter who does electronic piecework just as there have been examples of abuses in the garment and jewelry workers during the sweatshop era. As can be seen, telecommuting is not for everyone and requires a change of attitude and working culture both on the part of the employer and staff.

CONCLUSION

Telecommuting has the propensity, inter alia, to foster or accelerate the emergence of new telecommunication technologies such as widespread fiber-optic cabling to increase transmission capacity and reliability, digital switching and protocol conversion in telephone company facilities to facilitate faster, better service, and blur the distinction between voice and data transmission and, finally, to increase the use of satellite transmissions in order to cut costs and get around some of the limitations of the existing installed cable-based networks. Just as with any new project, careful thought and planning must go into a telecommuting program before it is allowed to proceed. Trial projects have been ongoing in different government departments and agencies, one of them being the remote-site pilot project implemented at DOC's regional office in the Toronto area.

Remote-site telecommuting was chosen over homework in order to alleviate some of the problems associated with telecommuting such as the need for human interaction and to make this project more attractive to a greater worker basin.

With values evolving towards a more individualistic approach of the employee, DOC should take a better look at the "electronic cottage" facet of telecommuting. Another pilot project should be put in place at headquarters where volunteer employees, who meet telecommuter criteria, would be allowed to work at home a certain number of days each week for a predetermined period. These workers and their supervisors would agree to be monitored during that time and once the trial phase is completed, results would then be used to implement such a working agreement in the department across the country.

Wouldn't the reader prefer poring over this paper in the comfort of a home nestled deep in the woods or by a lake with only the sounds of loons or other wildlife, lungs filled with fresh clean air, instead of looking at the perspective of driving back home on congested and polluted highways after a busy day at the office punctuated by crises and interruptions?

As many as 5 million Americans could be working at home in computer-related jobs alone by 1993, according to the Center for Futures Research at the University of Southern California.[18] In 1950 five of the ten largest cities in the world were in Europe and the United States. By the year 2000 there will be only one: New York City. During the same period meanwhile, the two largest cities in the world will be Mexico City and São Paulo, Brasil.

In addition, in the year 2000, the truly global cities will not be the largest; they will be the "smartest", those with buildings that run and monitor themselves through computers and connect occupants with the rest of the world through fibre optics, satellite telecommunications and cellular or cordless telephony.[19]

Teletext retrieval technology will put news, sports and banking information at a telecommuter's reach while providing at the same time shopping, financial data, and who knows how many dozens of other types of information and services to him or her as well as other people such as the ones suffering from disabilities? In any case, these projects have brought or will bring about new managerial concerns which need to be addressed. Next decade will be the triumph of the individual, the "me" society where a person's self will be fulfilled.

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[18]Aburdene, A., Naisbitt, J., **Megatrends 2000**. Avon Books, N.Y., N.Y., 1990, p. 331

[19]Ibid. p.332

The fact that telecommuting is new should not deter management from encouraging its implementation where it could be profitable. We need innovative approaches to help us meet new challenges. What remains is that our environment is presently suffering from our negligence and DOC has a predominant role to play in examining all available and emerging telecommunication technologies within grasp's reach to lessen that impact.