

**CIRANO**

Centre interuniversitaire de recherche  
en analyse des organisations

---

**Série Scientifique**  
*Scientific Series*

---

97s-36

**Moving towards the  
Virtual Economy:  
A Major Paradigm Shift**

*Louis-A. Lefebvre, Élisabeth Lefebvre*

Montréal  
Octobre 1997

## CIRANO

Le CIRANO est une corporation privée à but non lucratif constituée en vertu de la Loi des compagnies du Québec. Le financement de son infrastructure et de ses activités de recherche provient des cotisations de ses organisations-membres, d'une subvention d'infrastructure du ministère de l'Industrie, du Commerce, de la Science et de la Technologie, de même que des subventions et mandats obtenus par ses équipes de recherche. La *Série Scientifique* est la réalisation d'une des missions que s'est données le CIRANO, soit de développer l'analyse scientifique des organisations et des comportements stratégiques.

*CIRANO is a private non-profit organization incorporated under the Québec Companies Act. Its infrastructure and research activities are funded through fees paid by member organizations, an infrastructure grant from the Ministère de l'Industrie, du Commerce, de la Science et de la Technologie, and grants and research mandates obtained by its research teams. The Scientific Series fulfils one of the missions of CIRANO: to develop the scientific analysis of organizations and strategic behaviour.*

### Les organisations-partenaires / The Partner Organizations

- École des Hautes Études Commerciales
- École Polytechnique
- McGill University
- Université de Montréal
- Université du Québec à Montréal
- Université Laval
- MEQ
- MICST
- Avenor
- Banque Nationale du Canada
- Bell Québec
- Caisse de dépôt et placement du Québec
- Fédération des caisses populaires Desjardins de Montréal et de l'Ouest-du-Québec
- Hydro-Québec
- Raymond, Chabot, Martin, Paré
- Scetauroute
- Société d'électrolyse et de chimie Alcan Ltée
- Télélobe Canada
- Ville de Montréal

Ce document est publié dans l'intention de rendre accessibles les résultats préliminaires de la recherche effectuée au CIRANO, afin de susciter des échanges et des suggestions. Les idées et les opinions émises sont sous l'unique responsabilité des auteurs, et ne représentent pas nécessairement les positions du CIRANO ou de ses partenaires.

*This paper presents preliminary research carried out at CIRANO and aims to encourage discussion and comment. The observations and viewpoints expressed are the sole responsibility of the authors. They do not necessarily represent positions of CIRANO or its partners.*

# Moving towards the Virtual Economy: A Major Paradigm Shift\*

Louis-A. Lefebvre<sup>†</sup>, Élisabeth Lefebvre<sup>‡</sup>

## Résumé / Abstract

Ce document présente brièvement les quatre éléments moteurs qui sous-tendent l'économie virtuelle pour examiner ensuite la restructuration industrielle qui prend place actuellement, le rôle des entreprises virtuelles ainsi que la façon dont ces dernières se réorganisent en tant qu'intégrateurs de produits.

*This paper investigates some of the underlying forces that are propelling us towards the virtual economy. Special attention is brought to the industrial restructuring that is now taking place, to the role that virtual enterprises are playing in this transition, and to how these enterprises are reconfiguring themselves by acting as product integrators.*

**Mots Clés :** Économie virtuelle, entreprises virtuelles, intégrateurs de produits

**Keywords :** Virtual economy, virtual enterprises, product integrators

---

\* Corresponding Author: Élisabeth Lefebvre, CIRANO, 2020 University Street, 25th floor, Montréal, Qc, Canada H3A 2A5 Tel: (514) 985-4007 Fax: (514) 985-4039 e-mail: lefebvre@cirano.umontreal.ca

<sup>†</sup> École Polytechnique de Montréal and CIRANO

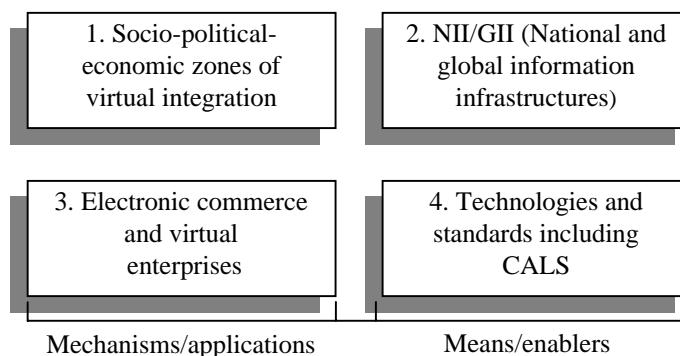
<sup>‡</sup> École Polytechnique de Montréal and CIRANO

## Introduction

The global economy is in the midst of a major transition to a new economic order, whose impacts on national and regional economies, industrial structures, businesses, organizations, public institutions, the work force and society in general are resulting in fundamental challenges to the scope of traditional industrial policies. The essence of this new economic order has been described as the “digital economy” (e.g. in Japan: MITI, 1997) or as the “information society” (e.g. according to the OECD, 1997). The expression “virtual economy” (Lefebvre et al., 1997) is chosen here since it best illustrates the concept of a **world economy without borders (whether temporal, geographic, functional or organizational) and refers, among other things, to the entities described as “virtual enterprises” and activities carried out electronically in real time.** In this paper, we examine successively four essential drivers of the virtual economy and present several models supported by concrete examples to investigate the virtual economy’s impacts on industrial structures and firms.

## The main drivers of the virtual economy

The virtual economy is based on four drivers which are derived from the actions of corporations, shaped by technological and economic developments and ultimately by the industrial policies pursued by nations, regions or subregions (figure 1). Although presented here sequentially, these four elements interact a great deal with each other, and thus must be seen as forming a whole.



**Figure 1**  
**The virtual economy and its four drivers**

- **New socio-political-economic zones** (box 1) are formed naturally by market forces, but also by political and social will and, increasingly, by the skills and competencies acquired of key players who have developed specific know-how for doing business electronically with each other. Thus, it is possible to imagine “virtual integration zones”, as is the case with certain Asian countries (Japan, China, Indonesia, Malaysia, Singapore and Thailand) with the MATIC project.<sup>1</sup> In the very long term, the virtual economy will be a world economy, fully integrated and interconnected. In the short and medium terms, the main challenge will correspond to the formation of harmonious economic trading zones although companies (especially multinationals) will obviously continue to operate in various countries without restrictions, based on their own needs for rationalization and optimization.

- **National and global information infrastructures** (**NII** – National Information Infrastructures, and **GII** – Global Information Infrastructure; box 2) are currently the focus of intensive efforts and major investments in many countries, which recognize them as a means of stimulating economic growth and generating new jobs (OECD, 1996; Kahin and Wilson, 1997). Information infrastructure goes beyond the physical infrastructure (i.e. the equipment, fiber optics, satellites or computers used to transmit, store, process and deploy voices, images, sounds and data). It also includes:

- (i) the information itself, of a scientific, commercial or cultural nature;
- (ii) the applications and the software that make it possible to manipulate, organize, analyze and transmit the multitude of information and, above all, to guarantee the security of electronic transactions, making electronic commerce possible;
- (iii) the standards and protocols which ensure networks' interoperability and interconnection;
- (iv) the people, who are, of course, essential to the development of tools, applications and services.

The **information superhighway** is an essential component of NII.

- **Electronic commerce** (box 3) consists of the use of electronic means to exchange information and carry out transactions among public and parapublic institutions and organizations and among firms themselves (Kalakota and Whintson, 1996). The term “**virtual enterprises**” (box 3) broadly refers to all companies which carry out various activities in virtual mode (in particular, design, logistics, commercialization, marketing, sales and after-sales service activities are being carried out virtually to an ever-

---

<sup>1</sup> MATIC (manufacturing technology supported by advanced and integrated information systems through international cooperation) is a five-year project which will be completed in 1999 under the direction of MITI (Japan).

increasing degree). In the narrower sense, virtual enterprises<sup>2</sup> are often temporary associations of hundreds or even thousands of stakeholders functioning on the same information platform for the duration of a project (Lefebvre et al., 1997). These parties are generally not members of the same firm and are not necessarily located on the same continent. This new way of working requires new competencies within companies, and especially the mastery of the various technologies and international standards necessary for electronic interconnections.

- The strategy with regard to the **choice of technological platforms** is thus crucial in a virtual economy and technological platforms such as **CALS** are emerging as the dominant strategy worldwide (box 4). CALS was started up in 1985 when the U.S. defense industry and the U.S. government joined forces to integrate their development, production and support systems. The “Continuous Acquisition and Life-Cycle Support” (CALS) strategy, formerly known as “Computer-Aided Acquisition and Logistic Support”, is intended to favor the integration of businesses around the world. CALS (also known as “Commerce at Light Speed”) is a global strategy which promotes the integration of businesses by rationalizing administrative processes and applying standards and technologies to the development, management, exchange and use of commercial and technical information.<sup>3</sup>

The virtual economy is therefore based on four essential drivers: on the one hand, the socio-politico-economic zones of virtual integration (box 1 of figure 1), electronic commerce and virtual enterprises (box 3), which represent mechanisms and applications; on the other hand, the NII/GII (box 2) and technologies and international standards including CALS (box 4), which designate means and enablers.

---

<sup>2</sup> “A virtual enterprise may be defined as a continuously operable, direct business venture based on the mutual collaboration of an array of potentially changing, independently operated component business entities. The assembled entities retain their separate corporate identities while forming a distinct new entity: the virtual enterprise. The component entities need not be collocated and may (or may not) be a portion of the same parent organization.” (Department of Defense, U.S.A., 1996) or alternately “A virtual enterprise involves people or companies in different geographical locations, whether several states away or halfway around the globe. It requires mastering specific technological skills so that the company can strike deals quickly then move on to the next deal with a different cast of players.” (Technology 2020, which acts as an incubator for virtual enterprises under the authority of the Department of Energy, 1996)

<sup>3</sup> Several other organizations have also defined CALS as follows: “Industry and government strategy intended to enable more effective generation, exchange, management and use of digital data supporting the life-cycle of a product, through the use of international standards, business process re-engineering and advanced technology application.” (Electronic Commerce Resource Center, U.S.A., 1995) or “A global strategy to further enterprise integration through the streamlining of business processes and the application of standards and technologies for the development, management, exchange and use of business and technical information.” (Innovation Business Service, U.S.A., 1996)

## **Virtual enterprises and virtual value chains : Some bases of industrial restructuring**

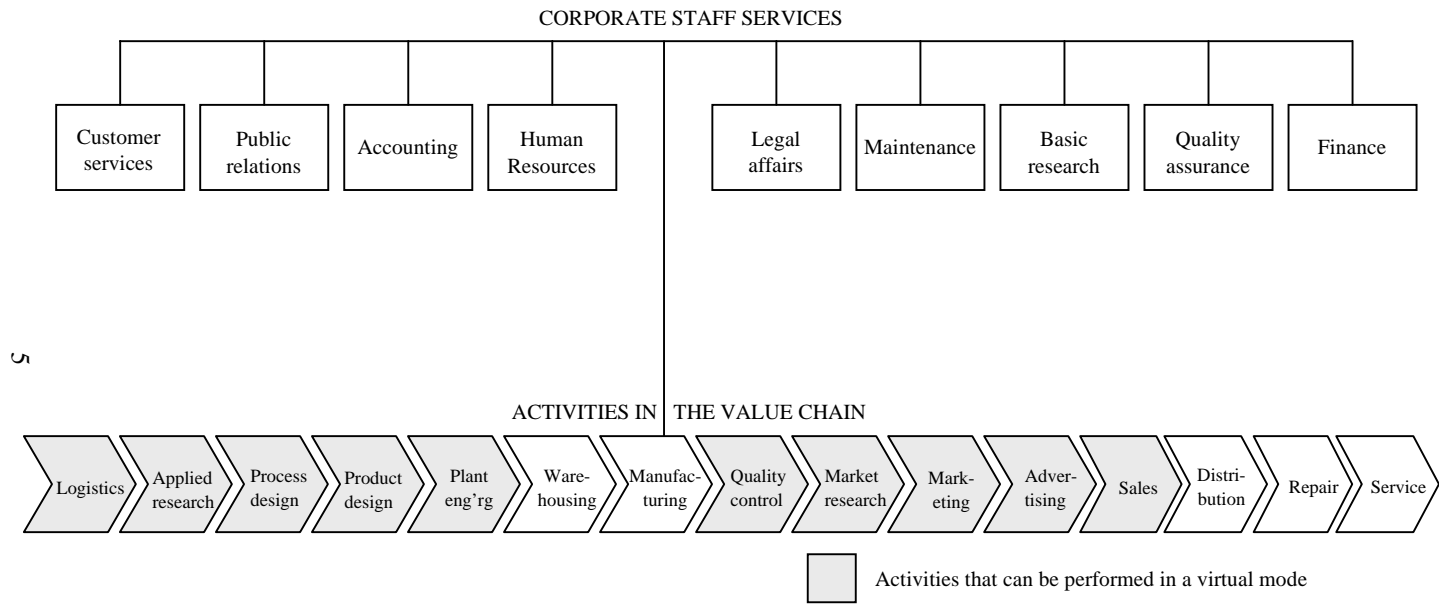
Many firms, organizations and institutions are already carrying out one or more activities electronically. The degree of sophistication of these activities ranges from simple substitution (e.g. electronic mail vs. the telephone) to the management of intercompany business processes, which represents the most sophisticated level. Cost reductions are substantial in all areas of activity, and this is true for governmental agencies, retailers, manufacturers or service companies.

### ***The virtual enterprise in its simplest form***

The virtual enterprise in its simplest form can be found in all sectors of the economy. Some companies may become completely virtual, others partially so, while still others may make a strategic decision to exclude certain activities from the virtual mode. An example of the latter case is banks, where all day-to-day, repetitive financial services are already virtual but specialized services like financial planning (e.g. mortgage renegotiation) may be provided in the comfort of the client's home. This context is one which we might call "High-Tech, High Social Contact". Banks are becoming almost virtual since physical location (i.e. the branch) is becoming less and less important. In terms of its consequences on the work force, we find that clerical-type positions (tellers) are disappearing and specialized jobs (investment counsellors) are very much in demand.

There are already some 250,000 cyberenterprises in the United States (Communication to the European Parliament, April 1997). These are essentially micro-enterprises which have been able to exploit the advantages of the information infrastructure and, more specifically, of one of its components: the Internet. In their simplest form, these firms have chosen the Internet as the sole tool for sales, promotion, distribution logistics and financial transactions; consequently, they are virtual since the end consumer does not know where they are and may never meet a member of their staff. In the case of a tangible product (book, CD, microcomputer, etc.), delivery is subcontracted electronically to an organization like UPS or Fedex. Amazon.com is the classic case of a virtual enterprise in its simplest form. This company, created less than two years ago, has no physical sales outlet but has become the biggest bookseller in the United States, with 2.5 million titles available, whereas the biggest physical bookstore has only approximately 175,000 titles.

If one considers more complex businesses, a firm's value chain (figure 2) represents a very simple way of visualizing its value-added activities, whether



Source: Adapted from Quinn, 1992

**Figure 2**  
**Virtual Activities in a Firm's Value Chain**



it is a manufacturing or service company.<sup>4</sup> As this figure shows, most activities can potentially be performed in virtual mode. When this actually happens, the firm becomes virtual.

For example, Dell Computer Corporation can be considered to be virtual on the basis of the following characteristics: i) no part or component is ordered from subcontractors until the company has received an order; ii) the computer is in the delivery truck less than 24 hours after receipt of the order; iii) sales realized on the Internet are undergoing exponential growth and represent over US \$1 million per day; iv) the average waiting period to receive payment for a sale is less than 24 hours (compared to 35 days for Compaq Computer Corporation). In 1996, Dell posted record sales (a 71% increase in number of microcomputers sold) and record profits (a 91% increase). This firm is beating out the competition with its selling prices, which are 10% to 15% lower than its competitors'.

Chrysler is another company where design is virtual, thus reducing the time to bring the new LHS model to market to 31 months (Chrysler uses CATIA). Chrysler foresees the prices of its models declining by 10%. It also sells its automobiles on line; this now represents 1.5% of its sales and it is estimated that this amount should rise to 25% within four years, according to the company's own forecasts (The Economist, May 10, 1997).

There are more and more examples of this kind and the success achieved by these companies is inducing others to follow in their footsteps. When we examine the value chain activities more closely, we can already anticipate the jobs that may be lost or displaced: engineers (design), sales representatives and salespeople, advertising agents, accountants, etc.

### ***The virtual enterprise in its most complex form***

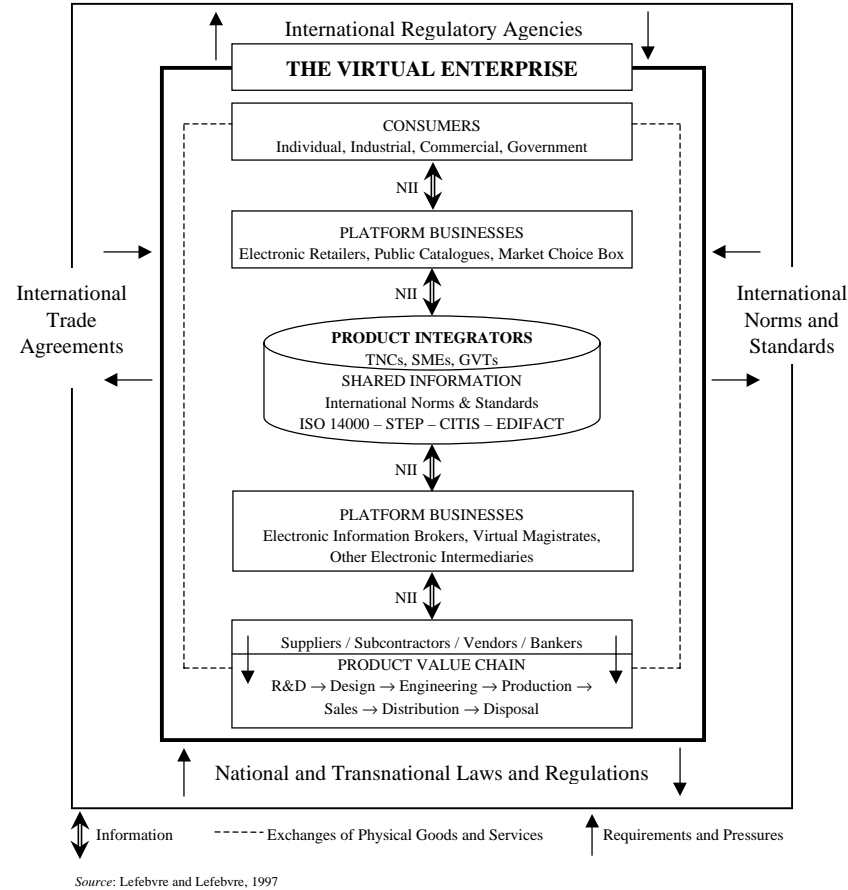
The emergence of virtual enterprises is also due in large part to the multinationals responsible for complex products which act as product integrators. There is no doubt of the influence these multinationals have, due to the considerable economic weight they represent. Their subcontractors and suppliers around the world really have no other choice than to adopt their ways of doing things. When this happens, we can see the virtual enterprise in its most complex form.

In the context where the network becomes the market, and in order to meet consumers' new requirements, some firms have reorganized as virtual

---

<sup>4</sup> In the case of a service company, some of the activities may not apply (e.g. applied research) and the term "production" may be replaced by "operations".

enterprises to allow the necessary closeness to the final consumer on one hand, and also to gain access to the best partners in the process of realizing the good, product or service. The model of the virtual enterprise is proposed in figure 3.



**Figure 3**  
**The Virtual Enterprise**

From the above figure, we can single out the following distinctive elements:

- In the center, there is a **product integrator**, which manages the physical product value chain as well as the virtual value chain, relying on common international norms and standards that apply to communications, product recognition (digitization) and transactions (financial, legal, etc.).

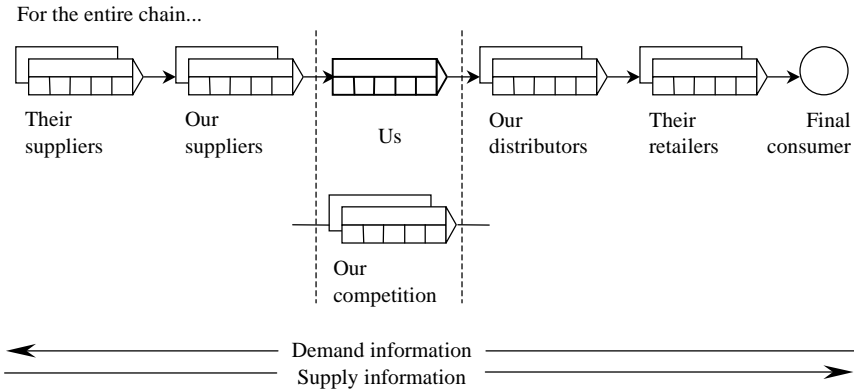
- At one end, we have the **consumer/customer**, who can deal directly with the product integrator or act through the platform businesses, which are virtual intermediaries offering value-added services like research, reference and change agency, virtual shopping centers or country sites such as the U.K. government's web site "Trade UK".
- In the bottom part of figure 3, we find the **various stakeholders, subcontractors, suppliers, vendors, etc.**, who may tender and offer their competencies to the integrator at various stages of the product value chain. These agents may be located anywhere in the world and work simultaneously with several product integrators. In this context, knowing how to tender becomes a key competence.
- Here again, we find **platform businesses**, which can act as intermediaries between the integrator and the various stakeholders and offer various services such as evaluation or search functions for both integrators and subcontractors.
- Finally, the **various national and international agencies** provide the framework within which the virtual enterprises operate and the norms and standards to be retained. In this context, the initiative taken by such countries as Sweden to jointly develop and diffuse norms and standards within their own industrial infrastructure is a good illustration of the efforts undertaken to provide the national regulatory framework for companies which wish to adopt specific technologies, norms and standards.

The virtual enterprise, as described, strives to offer customers the best product at the best price and within the best time frame. Further, we are moving from the age of mass marketing to the age of mass micromarketing, reflecting the producer's capacity to customize products while still maintaining the advantages related to mass production. To do this, the product integrator will try to maximize the added value at each phase in the completion of a product or service.

To sum up, the virtual enterprise possesses an organizational structure without borders, which does not occupy a specific time or space: it exists virtually, relying essentially on electronic interconnections. The virtual enterprise challenges all of its internal structures, the customer-company-supplier relationships and the industrial structures. The only criteria it retains are international standards and considerations of price / quality / flexibility / speed, and it does not rely exclusively on long-term relations of trust.

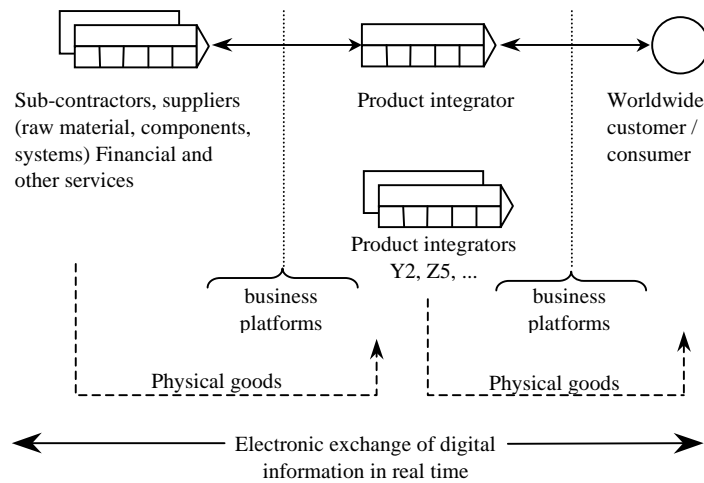
**The industry value chain**

The traditional industry value chain illustrated in figure 4 links a certain number of firms operating in a classical structure of predefined relationships.



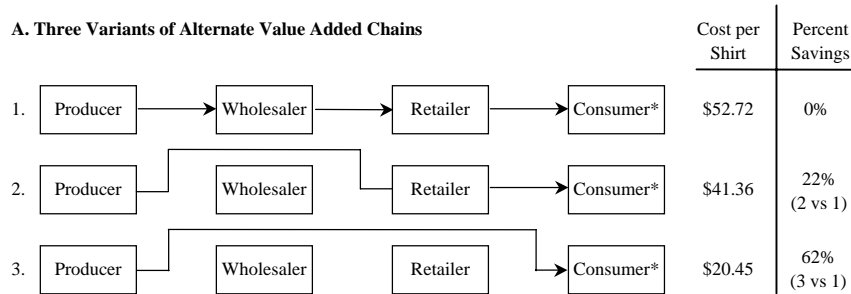
**Figure 4**  
**The Classical Value Chain in an Industry**

The new virtual industry value chain (figure 5), on the other hand, is centered around the product rather than the firm. A given firm may therefore be active in several product value chains, sometimes as integrator, sometimes as supplier/subcontractor.



**Figure 5**  
**The Virtual Industry Value Chain**

The transition from the traditional industry value chain to the so-called virtual value chain means that many traditional intermediaries will disappear, to be replaced by electronic intermediaries. We can already predict major upheavals in the retail and wholesale sales sectors (see figure 6): the traditional low-value-added intermediaries are at strong risk of disappearing. For example, subsequent to actions like those taken by Chrysler, automobile dealers are likely to see a decrease in sales and to gradually retain mostly maintenance and repair services. It is possible to envisage the sale of an automobile becoming an integrated service including delivery of the car, financing, insurance and a maintenance plan, with the whole being delivered to the customer on a turnkey basis. The customer would never have to leave home, nor would there be any physical transaction, thereby short-circuiting the dealer, banker, insurance broker, etc. The following example (Figure 6) illustrates how the intermediaries can affect product prices.



**B. Growth in Value Added and Selling Prices**

	Producer	Wholesaler	Retailer	Consumer*
Value Added	\$20.45	\$11.36	\$20.91	
Selling Price	\$20.45	\$31.81	\$52.72	\$52.72

\* Consumer transaction costs are not considered

Source: Adapted from Kalakota and Winston, 1996

**Figure 6**  
**Reconfiguration of an Industry Value Chain**

The virtual value chain therefore implies a profound industry restructuring. Moreover, it is possible that certain activities in the value chain might not meet the international requirements demanded by the product integrators, which could endanger entire sectors of the economy.

The relationship between the virtual enterprise and the virtual industry product value chain is presented in figure 7. We can observe that the virtual enterprise,

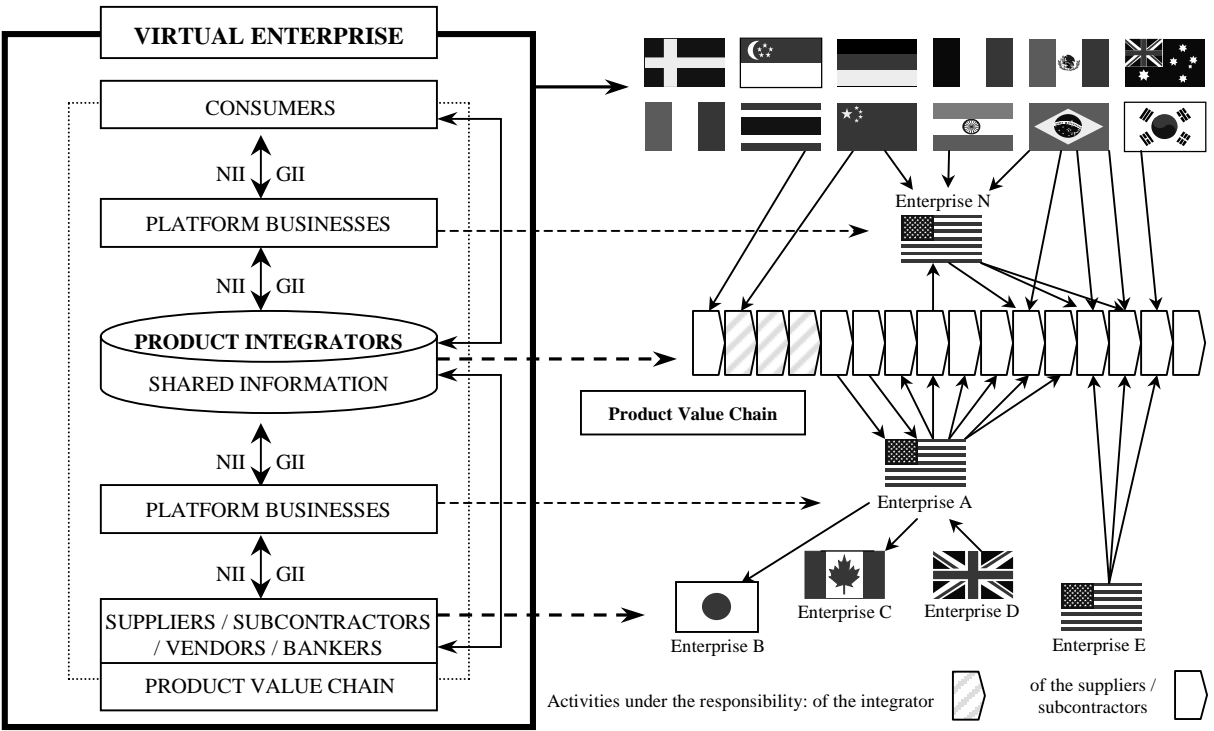


Figure 7  
The Virtual Enterprise and Its Virtual Product Value Chain

formed of a multitude of potential stakeholders, mobilizes around a product value chain which is its sole reason for existence. When the product has been completed, the virtual enterprise dissolves. Thus, one can imagine the dynamic in which the firm finds itself, one which relies on abilities to communicate, to tender, to import digitized information (in the case of durable goods), to work with this information (often produced in 3-D), and consequently to do business electronically, including with regard to financial and tax issues. Furthermore, this same firm would have to manage several value chains, where the parties involved and the configurations would probably, if not definitely, be different. This will require new know-how in terms of management mechanisms for firms accustomed to long-term relationships with a few prime contractors.

It should also be noted that product value chains differ depending on the complexity of the product in question. For example, the value chain of a Boeing 747 will obviously be more elaborate and complex than the chain for many other manufactured goods. However, all sectors of activities could be affected, even traditional ones such as health or agriculture.<sup>1</sup>

---

<sup>1</sup> “Virtual agriculture is not only analogous to networked computers, it will depend heavily on networked computers. The information infrastructure must play a new role, enabling frequent, easy, powerful, and inexpensive communication and coordination within and among agricultural partnerships.  
“Now, agriculture is driven by the logistical demands of serving large urban populations. It is made up of many highly specialized activities, involving many different individuals and groups. These diverse specialists conceive, design, develop, implement, and manage the activities that once were accomplished almost entirely by farmers. Farmers themselves have become specialists, functioning with other specialists in the industry of agriculture.”  
“Virtual Agriculture: Developing and Transferring Agricultural Technology in the 21st Century.” Illinois Agricultural Experiment Station, University of Illinois, 1997.

## **Conclusion**

With the numerous developments that are now under way, we are entering a period of profound changes. It is not yet clear exactly what effect these changes will have on individual firms and on the economy as a whole. One thing that is clear, though, is that the transition to the virtual economy is neither the cause of nor the solution to all the problems affecting the economic environment. It is however foreseeable that this transition will generate structural changes in both industries and individual firms, and will have profound impacts on the labor force. It will also raise fundamental issues about governance and social distancing.

We can be confident that NII/GII will be the enabling technology for the virtual economy, which is slowly emerging as a result of the proactive moves of some firms and institutions. The transition to this new economy will radically modify the ground rules of competition in both the long and the short term. It will become increasingly necessary to agree to operate under these new rules, bearing in mind that any change (whether or not it is technology-driven) affects people, firms, sectors and industries unevenly. This will undoubtedly be true of the transition to the virtual economy also. For all these reasons, we know that the choices made today will have deep implications for all nations of the world long into the future.



## Références

- The Economist (1997), *Electronic Commerce – In Search for the Perfect Market*, May 10, p. 3-18.
- Illinois Agriculture Experiment Station (1997), *Virtual Agriculture ; Developing and Transferring Agriculture Technology in the 21<sup>st</sup> Century*, University of Illinois.
- Kahin, B. and E. Wilson (Eds.) (1997), *National Information Infrastructures Initiatives: Vision and Policy Design*, A Publication of the Harvard Information Infrastructure Project in collaboration with the GII Commission, MIT Press, Cambridge, Mass.
- Kalakota, R. and A.B. Whinston (1996), *Electronic Commerce*, Addison-Wesley, Reading, Mass.
- Lefebvre, L.A., É. Lefebvre & P. Mohnen (1997), *From the virtual enterprise to the virtual economy : innovation strategies for the 21<sup>st</sup> century*, Discussion Paper prepared for Industry Canada, CIRANO, Center for Interuniversity Research on Analysis of Organizations, May, Montreal.
- MITI (1997), Ministry of International Trade and Industry, *Towards the Age of the Digital Economy – For Rapid Progress in the Japanese Economy and World Economic Growth in the 21<sup>st</sup> Century*, May, Japan.
- OECD (1997), *Information Technology Outlook*, May, Paris, France.
- OECD (1996), *Technologies, Productivity and Job Creation*, March, Paris, France.
- Quinn, J.B. (1992), *Intelligent Enterprise*, The Free Press, New York.

## Liste des publications au CIRANO \*

### Cahiers CIRANO / *CIRANO Papers* (ISSN 1198-8169)

- 96c-1 Peut-on créer des emplois en réglementant le temps de travail ? / Robert Lacroix
- 95c-2 Anomalies de marché et sélection des titres au Canada / Richard Guay, Jean-François L'Her et Jean-Marc Suret
- 95c-1 La réglementation incitative / Marcel Boyer
- 94c-3 L'importance relative des gouvernements : causes, conséquences et organisations alternative / Claude Montmarquette
- 94c-2 Commercial Bankruptcy and Financial Reorganization in Canada / Jocelyn Martel
- 94c-1 Faire ou faire faire : La perspective de l'économie des organisations / Michel Patry

### Série Scientifique / *Scientific Series* (ISSN 1198-8177)

- 97s-35 Seasonal Time Series and Autocorrelation Function Estimation / Hahn Shik Lee, Eric Ghysels et William R. Bell
- 97s-34 Do Canadian Firms Respond to Fiscal Incentives to Research and Development? / Marcel Dagenais, Pierre Mohnen et Pierre Therrien
- 97s-33 A Semi-Parametric Factor Model of Interest Rates and Tests of the Affine Term Structure / Eric Ghysels et Serena Ng
- 97s-32 Emerging Environmental Problems, Irreversible Remedies, and Myopia in a Two Country Setup / Marcel Boyer, Pierre Lasserre et Michel Moreaux
- 97s-31 On the Elasticity of Effort for Piece Rates: Evidence from the British Columbia Tree-Planting Industry / Harry J. Paarsch et Bruce S. Shearer
- 97s-30 Taxation or Regulation: Looking for a Good Anti-Smoking Policy / Paul Leclair et Paul Lanoie
- 97s-29 Optimal Trading Mechanisms with Ex Ante Unidentified Traders / Hu Lu et Jacques Robert
- 97s-28 Are Underground Workers More Likely To Be Underground Consumers? / Bernard Fortin, Guy Lacroix et Claude Montmarquette
- 97s-27 Analyse des rapports entre donneurs d'ordres et sous-traitants de l'industrie aérospatiale nord-américaine / Mario Bourgault
- 97s-26 Industrie aérospatiale nord-américaine et performance des sous-traitants : Écarts entre le Canada et les États-Unis / Mario Bourgault
- 97s-25 Welfare Benefits, Minimum Wage Rate and the Duration of Welfare Spells: Evidence from a Natural Experiment in Canada / Bernard Fortin et Guy Lacroix

---

\* Vous pouvez consulter la liste complète des publications du CIRANO et les publications elles-mêmes sur notre site World Wide Web à l'adresse suivante :

<http://www.cirano.umontreal.ca/publication/page1.html>