

# UNDERSTANDING INNOVATION ASSOCIATED WITH INFORMATION AND COMMUNICATION TECHNOLOGY

Research Report  
Presented to CEFRIO



September 2011

CEFRIO is a centre that facilitates organizational research and innovation with the help of information and communication technologies (ICTs). It regroups over 150 members from universities, industries and government as well as 60 associate and guest researchers. Its mission is to create a digital society for Quebec, using technologies as a lever for social and organizational innovation. CEFRIO, as liaison and transfer centre, works in partnership, to carry out research-experimentation, survey and strategic watch projects on the appropriation of ICTs in Quebec and Canada. These projects touch all sectors of the economy, both private and public. CEFRIO activities are funded at 64% by its own projects and at 36% by its main partner, the ministère du Développement économique, de l'Innovation et de l'Exportation.



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### **Innovation Capacity Index Using Information and Communication Technologies**

An initiative of CEFRIO and DMR Conseil, in partnership with the ministère du Développement économique, Innovation et Exportation du Québec, the ministère des Finances du Québec and the ministère des Services gouvernementaux du Québec and Industry Canada.

The research project on the Innovation Capacity Index using ICTs is aimed at better understanding the relation between ICTs and innovation. CEFRIO operationalized the model elaborated in its white book on the topic by studying twelve companies and organizations having exemplary practices with regard to innovation using ICTs. The project aims to pursue this goal, that is, to measure the contribution of ICTs to organizational innovation, with the help of indicators.

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## **TABLE OF CONTENT**

INTRODUCTION.....	1
1. THE TECHNOLOGY.....	3
2. SPACE, TIME, AND MATERIALITY.....	7
3. THE TRANSFORMATION OF MARKETS.....	11
4. MODELS OF INNOVATION.....	15
5. ORGANIZATIONAL READINESS.....	17
6. RISK TOLERANCE.....	21
CONCLUSION.....	25
METHODOLOGICAL NOTE.....	26
APPENDIX.....	27



## Introduction

In an increasingly computerized world, information and communications technologies (ICT) are rewriting the rules of competition and changing the very nature of organizations. Firms need to adapt continually as new markets open up, and close down, with very short notice.

Quebec has several strengths in this digital economy—notably a skilled labour force and a tax policy that fosters R&D. However, if we look beyond the ICT sector to the overall economy, Quebec is seen to be lagging. In the economy as a whole, investment levels in ICT are significantly below those in the rest of Canada, and even Canada-wide there appears to be an overall decline. In a recent ranking of e-readiness by *The Economist*,<sup>i</sup> Canada fell from 9th to 11th place between 2009 and 2010.

These data reveal an interesting paradox. While ICT-sector firms are seen to be prospering in Quebec and the labour force in this sector is well educated, organizations in other sectors do not appear to be adequately appropriating the advances made by the former, or to be benefiting from them in terms of innovation.

There are notable exceptions. Some firms have achieved remarkable innovations using ICT. This study reports an analysis of some ten cases of innovation that reveal how ICT can be used to good effect. The organizations examined are from a cross-section of sectors: service companies, manufacturing, media, government services, and retail. The results demonstrate that any kind of organization can innovate using ICT.<sup>ii</sup>

Our results provide an example to encourage public and private organizations to innovate using ICT. They also illustrate the conditions that must be satisfied if ICT is to provide strategic leverage. These elements may serve as a diagnostic tool for firms preparing their investments.

For governmental decision makers, our results open up new avenues of public policy. It becomes apparent that organizations' ICT-readiness is just as important as their actual investments in the technology. The government will now be able to put in place measures to promote preparations that will increase the profitability of investments in ICT and, ultimately, the productivity of our economy.

*It is possible for any type of organization to innovate using ICT.*



## 1. The technology

An examination of innovating organizations reveals that high-impact innovation does not necessarily require state-of-the-art technology. Of course, the newness of the technology is what allows innovation, but it must be accompanied by organizational transformation to yield a high impact. Indeed, the organizations we examined use a wide variety of technologies—ranging from an in-house blog to a portal for interacting with clients—and they innovate. Technology functions as a catalyst for reinventing how the company does business. We observe that newness is not necessarily a paramount factor to consider when deciding to innovate. Rather, novel ways of utilizing technology lead to innovation.

*High-impact innovation does not necessarily require the use of the latest technology.*

In the Oslo Manual,<sup>iii</sup> an innovation is defined as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.” ICT also play a role in support of the innovation process by providing new tools and new technological possibilities. Innovation is more about using a technology differently than merely about using it.

Newness is not necessarily a good thing. To be the first to use a technology increases the risk of investing either in a technology for which the optimal conditions of use are as yet unknown (implying that considerable learning costs must be borne) or in a technology that has no future. However, there is often a competitive advantage in being the first to innovate, even when using a technology that is already in place elsewhere.

### Types of technology

There have been longstanding efforts to identify which type of technology is likely to generate a particular type of innovation (product, technological, organizational, business model, or commercial innovation). Our observations suggest that this approach is futile. Nearly all of our case studies deal with several different types of innovation simultaneously. In fact, innovations that use ICT could never be entirely pigeonholed into a single category. Consider, for example:

- A new way of disseminating multimedia content (new business model) requiring technological developments (technological innovation) and a new structure (organizational innovation) to be adequately managed by the organization.

- A new Website to market products (market innovation) leading to the construction of a new warehouse and a complete reorganization of processes (organizational innovation).

In each of these examples, innovations affect several categories simultaneously. Studies conducted in Europe by Statec<sup>iv</sup> have arrived at similar conclusions. They demonstrate that the intensity of innovation is more informative than the category of innovation. Consequently, we see that it is the intensity of technology utilization that affects innovation rather than the technology type as such. These same studies establish a link between the intensity of ICT utilization and the intensity of technological innovation.

*The more intensive an organizations' use of ICT, the greater its chances of innovating in several areas.*

These two concepts are defined as follows by Statec:

- The intensity of ICT utilization is the number of technologies used within an organization.
- The intensity of ICT innovation represents the number of different innovations (at the level of the business model, process, technological, commercial, product, or organization<sup>1</sup>).

On the basis of these two ideas, we see that the greater the intensity with which an organization uses ICT, the greater its potential for innovation (it will have opportunities for innovations in all categories). Therefore, the ICT capital an organization uses provides it with a greater capacity to innovate. This capacity is also linked to the organization's human and organizational capital, as we shall discuss in Section 5.

This is likely why we observe that organizations that successfully achieve one innovation are rarely limited to only the one. Observations on the organizations in our study corroborate this proposition. One innovation is thus highly likely to carry further innovations in its wake. This "snowball" effect is apt to have a marked impact on the organization.

Since the intensity of ICT utilization encompasses all of an organization's technological capital, managers should not limit themselves to investing in the latest technology in the belief that this will result in high-impact innovation. They should focus on increasing the intensity of ICT utilization within their organizations.

One of the main conclusions of our study is thus that it is pointless for governmental decision makers to look for links between types of innovation and types of technologies in order to create incentives for the

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<sup>1</sup>For a description of these different innovation types: Aubert B., Cohendet P., Da Silva L., Grandadam D., Guimaron J., Montreuil B., "L'innovation et les technologies de l'information et des communications," published simultaneously by CEFRIO and le Centre sur la productivité et la prospérité de HEC Montréal, October 2010.

adoption of specific ICT. They must strive to increase the total national technological asset base rather than remaining narrowly focussed on specific technologies, such as broadband Internet. Investing in a portfolio of technologies and using them intensively will yield greater benefits than fostering any individual, specific technology if the purpose is to increase innovation in a country.

*The key to an organization producing innovations is maximizing the use of many technologies.*

First, it is tempting to believe that using state-of-the-art technology to innovate will produce more sweeping innovations. However, observations from a number of organizations within Quebec and elsewhere reveal that maximizing the variety of technologies used is the key to allowing organizations to generate innovations and obtain the greatest impact. The more an organization uses an assortment of technologies, the more capital it will have to allow it to innovate with greater ease and impact. This suggests that using a variety of technologies can spur the growth of a type of intelligence in their use, giving the organization the ability to reassess or adjust its business model in a continuous and dynamic fashion. Sections 2 and 3 contain some points to ponder regarding this IT know-how.

### **A measure of intensity of ICT utilization and of innovation**

When calculating an index of an organization's ICT utilization intensity, the number of ICT technologies used must be accounted for. This type of list allows comparisons to be made across organizations. An example developed by Statec is included in the appendix.

It is important to recognize that the presence of certain technologies can be seen as an indicator of a limited intensity of ICT utilization. For example, use of a modem is a good indicator that an organization has a very slow Internet connection. This technology thus signals a minimal intensity of ICT utilization. The intensity measure can be enhanced by including an indication of the number of users or of functionalities and applications associated with each technology.

The catalyst between the intensity of ICT utilization and innovation is the degree of organizational readiness, i.e. the extent to which the organization is ready to embrace innovation and optimize its performance. It is, therefore, not enough to merely increase the intensity of ICT utilization in an organization. Organizational preparedness also comes into play in the maximization of the impact of innovation. This involves complementary investments, such as in new competencies or new organizational structures. The degree of organizational readiness, as well as its links with the intensity of ICT utilization and of innovation, are described in Section 5 of this report.

**BOX I: History of ICT**

	1970s	1980s	1990s	2000s
Phase	Automation	Integration and organizational transformation	Communication	Interaction and customization
Innovation	Computers, robots, and machines	Personal computers	Internet (Web 1.0)	Web 2.0
Characteristics	Accumulation of physical capital	Widespread adoption of office automation tools Virtualization and transformation of business processes	Globalization of the computer network Standardization of interfaces	Connectivity of persons and objects Customization and portability Ubiquity
Economic impact	Productivity Growth	Productivity Growth Reduction in internal transaction costs	Productivity Growth Reduction in internal and external transaction costs Transformation of the value chain	Productivity Growth Reduction in internal and external transaction costs Transformation of the value chain Increase in informational benefits

Automation was the first technological innovation, allowing large firms to set up vast infrastructures underpinning their activities. At that time, ICT only played a support role, automating processes in order to enhance productivity.

As of the 1980s, the use of personal computers became widespread within organizations. This innovation launched the democratization of technologies. Indeed, the smallest firms could now have access to these computers, and by extension to technological advances. This allowed a greater decentralization of activities. Also, ICT evolved to become more strategic as it allowed all the information within organizations to be integrated, reducing the cost of internal transactions.

The Internet was the next major technological innovation, providing organizations with many opportunities for interactions. Personal computers now also became tools of communication. The Internet opened up new horizons for organizations to innovate. Companies such as Dell, Amazon, and eBay arose. These businesses offered distribution and marketing modes that took advantage of the emergence of the Web. Also, technologies arrived that transformed the value chain by greatly increasing the value added.

Finally, as of the 2000s, Web 2.0 made bi-directionality and customization possible. Furthermore, thanks to this new technological innovation, it is now possible to reach more actors, whether suppliers or clients, and to create communities that encourage exchanges between partners. This also increased the portability of platforms to make it possible to reach actors anytime and anywhere.

Adapted from : Aubert B., Cohendet P., Da Silva L., Grandadam D., Guimaron J., Montreuil B., L'innovation et les technologies de l'information et des communications, published simultaneously by CEFRIO and le Centre sur la productivité et la prospérité de HEC Montréal, October 2010.

## 2. Space, time, and materiality<sup>v</sup>

Our analysis of innovating organizations has revealed a link between innovation and three core elements: time, space, and materiality. These elements have an impact on the effect of the innovations delivered. Firms in which the innovation allowed by ICT had a medium or high impact operated on both the “space” and “time” dimensions. These businesses did not necessarily “dematerialize” (or “virtualize”) any products.

*Distance is no longer an obstacle for organizations.*

Innovation allowed by ICT had the least impact in firms that only operated on the virtualization aspect of goods and services. In these cases, the dimensions space and time were essentially unaffected.

We see that these three dimensions are key to entrenching an innovation within an organization. However, acting on space and time appears to be a promising strategy for obtaining the greatest impact from the innovation. It must be borne in mind that, despite these observations, there is no “magic bullet.” The best recipe for success is to judiciously operate on several of the elements space, time, and physicality simultaneously.

### **The relationship to space:**

In this age of globalization, firms are offshoring entire swaths of their activities, especially to China, India, and Eastern Europe. However, this physical distance does not impair the efficiency of the organizational value chain because ICT allows remote activities to be highly coordinated with the firm’s other activities. Thus, space no longer creates an obstacle for firms that can use ICT to overcome geographical hurdles. ICT allows seamless management of the spatial dimension of the value chain and coordination of cycles that run concurrently.

A typical example of this potential made possible by ICT is the establishment of call centres in three time zones to allow an organization to provide continuous 24 hour service to its clients or suppliers while its staff works normal hours. The ICT involved in these cases are data management tools that allow real-time coordination between all the call centres. This possibility has allowed many organizations to reach a new international clientele. At the organizational level, it has also facilitated the management of international bodies by improving communications between branches. Another example is the integration of mobile functions allowing the efforts of travelling workers to be optimized. This results in higher customer satisfaction ratings (greater responsiveness

and speed in resolving cases) and increases the employees' comfort level at work (less travel time).

This spatial modification can also be seen at the individual level. It is possible to contact any individual anywhere on the planet instantaneously. For example, developers in a Quebec communications agency found answers to their questions in their virtual community. Merely posting a question on that Website was all that was required to rapidly obtain a response from someone somewhere in the world. Also, by redefining physical barriers a bookstore was able to sell rare books, in particular those that are out of print, to its customers. As a consequence, we see that individuals no longer travel as much to obtain a good or service, resulting in a reconceptualization of distance and space thanks to ICT. It has become much easier to conduct business with partners located around the world, thus benefitting from new expertise.

*ICT allow firms to operate around the clock.*

### **The relationship to time:**

ICT have also transformed the relationship to time, allowing access to information that is instantaneous, transparent, and increasingly complete. Information is thus available to users of information technology at all times. This has allowed one television network to make its products available free of charge on the Internet, enabling its viewers to watch their shows whenever they wish. Furthermore, thanks to computers, smartphones, and tablet computers, individuals no longer need to be in front of their TVs when the show airs. They can choose when to watch the television show, when to take a break during the broadcast, or when to fast forward. Thanks to ICT, the television viewer is now in control of the show's temporal aspect. This network is now reaching a new clientele and positioning itself ahead of its competition on the digital wave. It is also active on the spatial dimension, since smartphones allow users to watch shows where they want.

In addition, ICT have allowed companies to operate continuously, sometimes even 24/7, and thus overcome temporal limitations associated with the place of work. For example, one communications agency has allowed its employees to work when they wish, even outside of office hours, thanks to the use of ICT to telecommute.

This principle applies to online services. For example, banks make their services available online 24/7 to meet their customers' needs for access. This desire of customers to obtain services around the clock has created pressure on government bureaucracies to aggressively launch online portals. One ministry in the study took this reasoning to remarkable lengths, so that citizens and firms doing business with this government

can perform virtually all of their transactions online, whenever they like, including an impressive array of financial transactions.

Organizations can meet the current needs of clients rapidly and with continually expanding content thanks to the time savings ICT allows them with their processes. Using ICT, a bookstore reviewed and optimized its processes to shorten its turnover time and thus increased its warehousing and sales capacity. ICT used for automation and in-house information transmission are vital to process optimization. One television network had to optimize its processes for digitizing content so as to be able to post it online rapidly. ICT proved useful for this initiative, because the use of data processing and storage tools now make high-speed digitizing practical. These cases reveal that the initial step is a process reengineering exercise supported by technical support staff.

Virtualization allows a new international clientele to be reached and processes to be coordinated with business partners. A bookstore was able to benefit from technological innovations to harness an apparent competitor, Amazon, as a collaborator for selling its own products.

Another striking example is a furniture manufacturer that used ICT in order to automate the production process, and thereby took great strides in overcoming the handicap posed by its distance from the U.S. market. In fact, the only remaining downside is an additional one-day delay for the delivery of express parcels.

### **The virtualization of products, services, and the value chain:**

ICT have also revolutionized the nature of the products and services consumed. In the same way as they opened the door to virtualization of the value chain, ICT allowed products and services to be virtualized. For example, by digitizing part of its collection a bookstore was able offer more products on its Internet sales portal.

Also, some digitized products have been transformed into services by ICT. For example, the NFB (National Film Board), which is in the business of conserving and lending films, digitized the films in its collection in order to make them available to the public over the Internet.<sup>2</sup> The digitization of films made possible the provision of a new service over the Internet because users can leave comments, see links between films, and learn about new works. This has also allowed their contents to be indexed so that clients can find what they seek quickly. The same government agency has thus been able to fulfill its mandate and easily render its

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<sup>2</sup>Lalonde, Denis, Le virage numérique de l'ONF, Direction Informatique, 11/05/2011, [www.directioninformatique.com/DI/client/fr/DirectionInformatique/Nouvelles.asp?id=62468&cid=81](http://www.directioninformatique.com/DI/client/fr/DirectionInformatique/Nouvelles.asp?id=62468&cid=81)

content accessible to customers. Also, virtual products can be transferred from one platform to another, making possible multi-platform compatibility involving Apple's iPhone and RIM's Blackberry. In fact, the line between product and service is vanishing.

Some products cannot be virtualized. A furniture manufacturer will continue to use wood, and the furniture will always be shipped physically. However, even a maker of furniture has some part in virtualization. The catalogue is virtualized, allowing the selection offered to depend on the clientele (greater customization). In addition, by working with modular products (like Ikea), the manufacturer virtualizes a portion of the production and sales process to some extent. We see that such a manufacturer can sell anywhere, like a local merchant, by forming alliances with the principal retail sites. Furniture can also be sold 24/7, with guaranteed next-day shipment thanks to tight integration between the sales site, the production process, and transporters.

### **Measuring space, time, and virtualization**

To measure organizations' ability to use ICT to act on these three dimensions (space, time, and virtualization) simultaneously, each component must be measured separately. It is necessary to assess whether ICT are used to detach the activities from the location of the customers and enable them to conduct their interactions when they want. As to whether the transaction is physical in nature, it needs to be determined whether the information can be separated from its carrier. In this event, channels of dissemination become electronic, allowing much wider and cheaper dissemination.

### **3. The transformation of markets**

Markets are transformed by ICT in three dimensions: their size, the depth and breadth of content offered, and the interconnection with clients and partners. To maximize the impact of an innovation it is important to involve all three dimensions. One method used by organizations has been to virtualize the value chain, making it easy to work on all three dimensions.

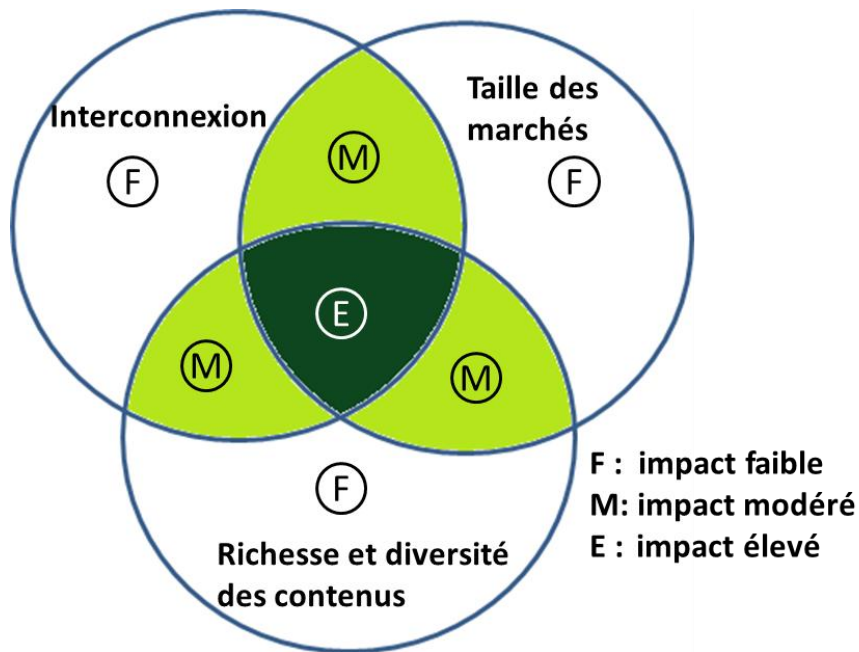
The organizations canvassed in this study all capitalized on this element of interconnection in their innovation. Thanks to ICT, a bookstore has succeeded in using its Website to reach a broader clientele and sell a wider array of products. Thus, interconnection appears to be an important element of success in innovation, which is hardly surprising in light of the current environment that is oriented toward a proliferation of connections with clients and suppliers.

However, organizations must act on other dimensions for innovation to have a significant impact. The organizations in our study that experienced a medium or high impact capitalized on market size.

It appears that the breadth and depth of content is central to achieving a high impact. This depth involves more than adding virtualized products, it is about expanding the slate of offerings. For example, a manufacturer of furniture ventures into a consumption universe in which the sale of furniture is only a part. A consumer may select an article of furniture, and at the same time order the bedspread that appears on it or some other decorative article in the picture—thus buying either the product or the decor.

These results reveal that it is important to consider all dimensions of market transformation made possible by ICT to obtain innovation having the highest impact. Consequently, no dimension can be said to be more important than any other. Market size and content diversity are the two dimensions that appear to be associated with the highest impacts in our case studies. Interconnection appears to be necessary but not sufficient to ensure that an innovation will have a high impact.

Figure I summarizes the results.



**Figure I: Impact from different types of transformation**

The marketing mode may provide access to new markets. One firm in our study operated exclusively “business-to-business” (B2B). Its products were distributed by retailers. Opening an online boutique allowed it to directly reach the end consumer with products having a high value added—allowing it to penetrate the retail market. In addition, success in online sales could open the door for distributors to venture into new products.

A television network operated on all three dimensions to ensure a high-impact innovation. It approached its suppliers for permission to post their content online. It had to improve its connections with its suppliers and with its clients by adding interactivity to the content portal and monitoring its community of viewers using Web 2.0. This innovation allowed the network to operate on market size by reaching a new clientele using a tool (Internet) more popular with younger viewers who are abandoning traditional TV. Finally, the network was able to capitalize on the breadth and depth of its content by acquiring innovative new content for its portal. All three dimensions, market size, content, and interconnection were thus developed in a consistent fashion to maximize the impact of the innovation on the organization and on the market. It was a resounding success.

*A global audience*

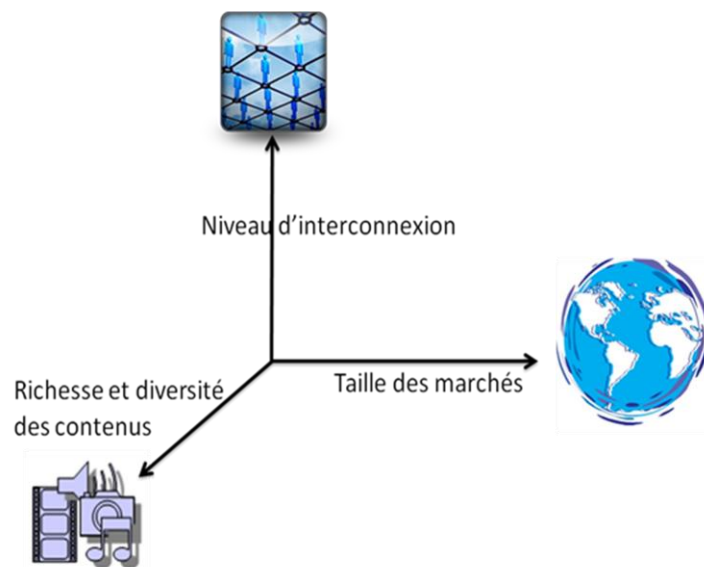
## BOX 2: Breadth and diversity of content, interconnection, and market size

ICT transform markets thanks to innovations that can operate on three axes:

- **Market size:** By allowing products and services to be accessed anywhere in the world, regardless of the location of the client or the supplier, ICT allow markets to be expanded and open up new vistas for organizations.
- **The breadth and depth of content:** ICT allow some products and services to be virtualized. This allows organizations to enrich and diversify their content, so that they are able to innovate and develop a new selection of services to offer their customers.
- **Interconnection:** New communications technologies, in particular those based on the Web, make it easier for organizations to reach commercial and individual partners, making them more interconnected.

Thus, innovations operate on the three following axes:

### Market innovation axes enabled by ICT



Adapted from : Aubert B., Cohendet P., Da Silva L., Grandadam D., Guimaron J., Montreuil B., L'innovation et les technologies de l'information et des communications, published simultaneously by CEFRIO and le Centre sur la productivité et la prospérité de HEC Montréal, October 2010.

A furniture manufacturer became a supplier of reference for several large online distributors in the United States. To the client, the order / billing / delivery / after-sales-service operations must be transparent. This is only possible with an external interconnection of information systems between the firm and its distributors and an internal networking of systems. Once committed to comprehensive automation, the firm can accelerate the processing of orders and manage large volumes.

As a consequence, to obtain the maximum impact from an innovation it is important to operate on all three dimensions. This requires that new competencies be acquired. This notion will be explored in greater detail in Section 5 of this report, which addresses the issue of organizational readiness.

Virtualization makes it possible to operate on three dimensions—in particular market size. This consists of using ICT to fully virtualize a product, making it transportable and usable everywhere thanks to computers. This was the case for two of the organizations we studied. Their video content was digitized and distributed on the Internet. Their potential audience thus immediately became global.

### **Measuring market transformation**

To translate these dimensions into a measure allowing the innovation efforts made possible by ICT to be better targeted, it is necessary to verify whether the three dimensions are present and used during each application of ICT to innovation. If they are not, a manager should determine whether this would be desirable (and feasible). Leaving any of the three dimensions aside when deploying an innovation made possible by ICT is similar to failing to cash in all the income yielded by an investment. This is something that all organizations should shun.

## 4. Models of innovation

How organizations innovate has undergone a transformation in recent years. Traditionally, organizations have followed a “closed” model, sequestering in-house expertise to protect their ideas and innovation and prevent copying. However, in order to reduce transaction costs and have access to the knowledge of external agents, a number of organizations have moved to a more open model. ICT have facilitated this transition because they provide the channel for opening to other partner entities with the virtualization of information and they expedite electronic exchanges. A process of innovation is not, generally, either completely open or closed, and so the issue confronting organizations is to know to what extent the innovation process can be opened up.

*Coordinating with customers and suppliers to benefit from their new ideas.*

Observations on innovating firms reveal that the open model permits optimization of ICT’s impact on the capacity to innovate. Therefore, innovation, especially when it involves ICT, must be done in collaboration with clients and suppliers. Internally, it is necessary to create a synergy to allow staff from different departments to work together. For example, a library created new partnerships with its database providers in order to expand its supply of services and enhance its business model. One agency created an open workspace so that employees could freely exchange their ideas throughout the organization. It also created a virtual space called “Laboratory” where all employees can interact and exchange on professional and personal projects. This initiative was enhanced by a culture based on innovation that allows its impact to be maximized. These organizations benefited extensively from their partners’ new ideas.

When the delivery of a product or service involves several steps, some tend to be more open and others more closed. For example, in the case of a television network that launched an online portal for televised content, the innovation process was globally open but the initial impetus emerged in a closed fashion. Only when the idea was in the development and implementation stage were new stakeholders solicited to enrich and contribute to the project. At this point, individuals from management, specialists, and external producers became involved. Rather than distinguishing between processes that are globally open or globally closed, it might be more useful to differentiate a project’s stages of implementation by its degree of openness.

Since ICT make it possible, among other things, to generate interconnections, to alter the relationship to space and time, to enrich content, and to increase the size of markets, a solid mastery of ICT makes it possible to better control what will be open and what will be closed.

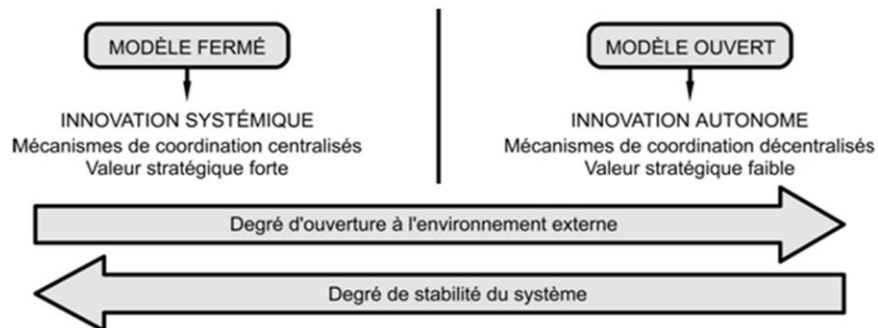
It becomes important for organizations to determine which stages of the innovation process should be managed in an open fashion and which should be held to a more closed standard.

### BOX 3: Models of innovation

The “closed” model of innovation is based on control *from within the boundaries of the firm* of the entire information chain along which the innovation proceeds, starting with the emergence of the creative idea and ending with its commercialization. The advantage of this model is the ease with which the innovative process can be controlled, since the data is in-house and there is no risk of copy, provided the information can be prevented from leaking.

The open model is based on the fact that, thanks to developments in ICT, firms can now use *both in-house and external expertise to innovate*. They transfer some of their innovation-related research and development activities to external partners (clients, suppliers, universities, research centres, etc.). This model allows organizations to accelerate the innovation process by taking advantage of all external expertise. The limitations of this model lie in the creation of a governance structure to manage external inputs; coordination with external agents is more complex, requiring greater efforts from the organization.

The figure below illustrates the distinction between these two models.

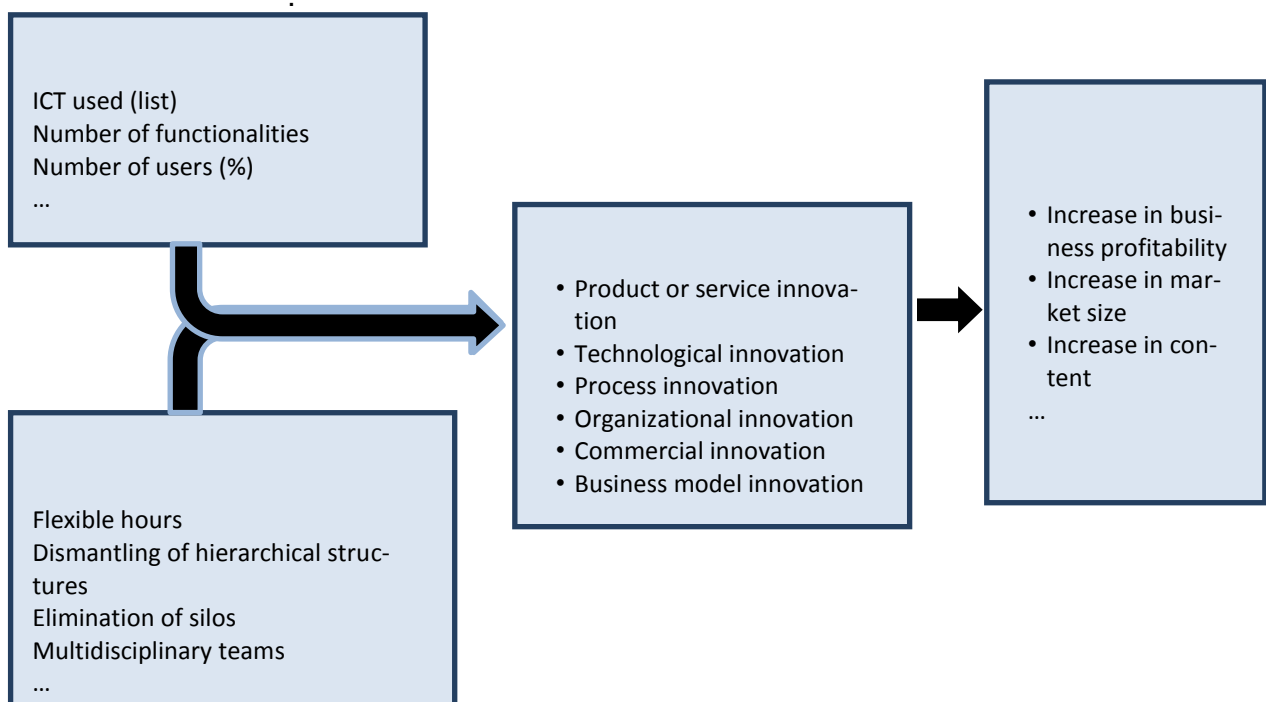


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## 5. Organizational readiness

To maximize the impact of an innovation, it is important that the organization be ready to embrace and develop it. Thus, complementary investments such as organizational transformation and the development of new competencies are necessary to fully benefit from the deployment of ICT. This factor thus combines the intensity of ICT utilization to affect the intensity of innovation.

The model of factors that explain innovation can be represented as follows:



**Figure 2: Factors explaining innovation**

We see that the organization's performance is positively affected by the intensity of innovation it achieves. As explained earlier, the intensity of ICT utilization and the intensity with which organizational practices are adopted are positively correlated with the intensity of innovation. Thus, on one hand, a portfolio of several technologies must be acquired. On the other hand, the organization needs to be primed for innovation by establishing organizational practices that support ICT and innovation. Congruence of these two factors will allow the impact of the innovation to be maximized, resulting in better organizational performance and higher yields.

If we consider more than one period, Figure 2 can give rise to a positive feedback effect. Indeed, organizations that obtain performance improvements are then able to invest more in ICT and in exploring their potential, enabling them to increase efforts linked to new organizational practices. Subsequently, they can generate a new cycle of innovations and once again improve their performance level.

This appropriation of technologies to innovate and improve performance creates an interesting learning curve. In the case studies, organizations often conducted an initial process analysis to identify relevant ICT, which in turn revealed additional opportunities for process optimization.

Different types of investment can enhance the capability of the organization to implement the innovations promised by ICT:

- **Organizational changes:**

The purpose of these investments is to make internal processes more conducive to innovation. This may involve structural changes to consolidate all the expertise required for innovation, as was the case in one governmental organization that brought all its computer skills from every department together into a single branch. Increasing the accountability of the different resources can also be considered as a way to broaden their scope for innovation.

- **New expertise:**

To acquire new skills and competencies in support of innovation, hiring personnel or introducing external expertise by engaging consultants may be options. Some training techniques may also be used to foster learning. For example, one government used “shadowing,” whereby its employees followed external consultants and observed them perform their tasks in order to learn how to complete the innovations themselves. Focus should be on the acquisition of new competencies by working as a group and in partnerships.

- **New facilities:**

Physical investments may be necessary for realizing the innovation. For example, a book seller had to invest in warehouses to increase storage capacity and to meet the demand arising from the new online sales service. A ministry had to revamp the layout of its offices to accommodate new, mobile styles of work.

*It is important to seek out new expertise and work in a multidisciplinary mode.*

- **Multidisciplinary teams:**

To have a high impact, organizations must make it possible for their team members to work together across different departments or sites. Despite the challenges encountered when assembling resources of different languages and/or cultures, it is important to make this effort to optimize innovation. A horizontal work structure is thus preferred for fostering innovation. Several of the firms studied emphasized the importance of combining different skill sets to obtain significant innovations.

- **Appropriate support:**

A commitment from upper management is vital for ensuring successful innovation. Strong leadership is also required, but this will not necessarily come from above. In fact, different types of leadership may come into play depending on the innovation to be implemented. For example, if the innovation affects the actual processes of the organization, the impulse for the innovation project might come from a member of the organizational staff. When the innovation is peripheral to the organization, a team could operate “off the beaten path” to ensure that the innovation is not derailed by organizational inertia. Finally, when the innovation is highly strategic, it must be guided and championed by upper management.

- **Complementary investments:**

Other complementary investments might be required. For example, a government had to amend its laws to allow online services to be utilized to maximum effect by its citizens and businesses. New definitions were needed of what constitutes a “document,” a “signature,” a “request,” an “authorized agent,” etc.

Investments can thus take several forms. Failing to make these investments severely impairs the innovative potential made possible by ICT.

### **Measuring the organization’s readiness**

An organization that is planning an ICT investment must compile a list of investments required create an environment that is conducive to its success. These investments should be coordinated with the ICT investment.

There are, however, questions that must be asked prior to investing in ICT. After identifying the various investments required to prepare the organization to welcome the innovation:

*Failing to make these complementary investments severely impairs the innovative potential made possible by ICT.*

- Are we able, from a financial and an organizational perspective, to make these investments?
- Do we already have the skills, assets, and capacity to deliver these investments?
- Do we need to make these investments? Can we make do without them?

## 6. Risk tolerance

*A readiness to take risks is required.*

Observations on the organizations in the study reveal that it is necessary to take risks to innovate and obtain the desired results. The ability to assume risk is an essential element to be put in place to foster innovation. Indeed, if there is no risk taking internally, creative ideas can never be tested and result in an innovation. The organization will be hamstrung by fear of risk and failure. Innovation involves new organizational practices: accepting failure, not planning everything, adapting innovations to opportunities as they arise (flexibility), and fast response. One of the common threads running through all the successes observed among the firms in the sample is clearly the organizations' ability to assume risks.

### Allowing failure

In allowing employees to test ideas that may not go anywhere, the organization is signalling that failure will be tolerated and thus maximizing the likelihood of innovation, since ideas will be tested. Allowing failure also involves instilling a culture that does not penalize individuals who have been associated with failure, a culture that needs to permeate all levels. This is the case, for example, with Google, which has organizational practices that allow for failure. When employees believe that they have an innovative idea, they only need support from a handful of coworkers. In this case, Google will provide a small fund to begin experimenting with the project. If it promises to yield something of value to Google, more money is forthcoming. Google openly admits that it finances failures, but the innovations generated from this risk taking give it an edge over its competition and allow it to innovate. Only a small percentage of these ideas need to see the light of day to generate large profits.

### Not planning everything

*The planning effort must not cost more than a quick test of the idea!*

Risk taking also involves decreasing the time spent on planning. In fact, while it is essential to guide an innovation project, care must be taken not to invest too much money in diminishing the uncertainty of the project to avoid failure, because it is the risk that makes room for innovation. Trying to reduce uncertainty curbs creativity, flexibility and, by extension, innovation. Time is wasted planning rather than innovating, and the cost of all the planning ends up exceeding the cost of a quick trial of the idea. For its new content portal project, a television network optimized its time allocated to planning by involving all stakeholders. However, deployment of the portal was rushed to stay ahead of the competition, and so adjustments had to be made on the fly in response to its performance. A trial and error based process emerges from these

cases. This allows ideas to be tested in shielded and constrained environments to measure their impacts and make adjustments before generalizing.

### **Adjusting innovations to reflect opportunities**

Observations on innovating organizations reveal that innovation is not set in stone. It needs to be adjusted to respond to opportunities and changes in the environment. In fact, while the innovation is being implemented some elements may change, meaning that the original idea is no longer as innovative as it was. Therefore, it is important to reconsider the idea, to amend it and resist the temptation to render the innovation inflexible. A government expanded its Internet portal by allowing its clients to access services (pension, taxes, etc.) in response to requests from its partners. The portal evolved to become a locus for exchanges between customers and the government, and with several of the customers' partners (with the government functioning as an intermediary). This openness to change allowed this government to innovate and set itself apart from other administrations. We can view the transformation process as a blending of vision for the future, the planning of phases, experimentation, and the ability to seize opportunities that chance throws in the way.

*Room must be left for a flexible innovation process.*

### **Fast response**

Having a tolerance for risk and reviewing innovations in response to opportunities allows organizations to earn unexpected windfalls. It is important to understand that this is a part of innovation, and that these profits need to be evaluated to appreciate the value of innovation. For example, a television network was totally unprepared for the overwhelming success of posting its content online. Compared to the initial planning and estimates, innovation far exceeded expectations. It became necessary to adjust the platform to fully capitalize on this innovation. This type of adaptation requires a certain degree of agility. Another example is provided by the furniture manufacturer. During the first tests of online sales, the firm met with unanticipated success—quite exceeding everyone's expectations—leading it to reinvent its business model from the bottom up.

### **Measuring the capacity to take risks and adjust**

A communications agency illustrates well how to deal with risk tolerance within an organization: "Some projects are spontaneous; they are the initiatives of team members. The ideas may come from a co-worker in accounting or an expert in computer architecture. To foster that, we have a space that is open to all ... open in a general way, i.e. not only

within the company but open on the Web, which is a laboratory. We encourage our people to publish, to share their ideas, their projects, and the errors they have made so that others can draw inspiration from their experience.”

All things considered, organizations that wish to obtain high impact innovation have to make room for failure. It is better to refrain from planning every little detail so as to allow room for flexibility and promote innovation. Finally, it is important to take advantage of opportunities to adjust innovations and thus earn unanticipated profits. It is important to ensure that planning does not take the place of action.

In the case of an organization, it is possible to formally measure the percentage of time spent on evaluating projects (planning) and the time spent testing and implementing them. The success rate is also a type of indicator. An organization that has a high success rate probably is discarding many projects that are riskier and potentially more profitable. Finally, an evaluation of the organization’s culture of risk can be conducted to find out whether risk is rewarded or stigmatized.



## Conclusion

Observations on innovating organizations reveal that ICT play a central role in innovations. In particular, the more an organization is able to use ICT intensively and accompany it with sound complementary investments, the more the innovation will be important for both the organization and the market.

The “poorer” a firm is technologically, the less it will tend to combine innovations, or even to innovate. Conversely, the more a firm is ICT intensive, the more it will tend to innovate and proliferate types of innovations.

A key factor that appears in the observations is organizational readiness, which reflects how open the organization is to embracing the innovation made possible by ICT. This involves establishing organizational practices that foster innovation, such as risk taking, tolerance for failure, and setting up multidisciplinary teams. These investments may also support innovation, as in the case of the acquisition of warehousing space or a new technological platform. In other words, investments need not only be technological, but also organizational, so as to maximize the intensity of innovation and its benefits.

We can construe innovation as a puzzle to be solved. All the pieces represent elements to consider, such as the development of new competencies or the creation of multidisciplinary teams to foster the emergence of new ideas. However, these pieces are in constant flux as they evolve over time. To maximize innovation, it is thus a matter of assembling the pieces and fitting them together so that all the elements of innovation are aligned and matched. To embrace innovation, investments must therefore be carefully selected as a function of both the market situation and the needs of the organization. It is also necessary to readjust these pieces of the puzzle dynamically to reflect developments in the innovation, the market, or technologies.

In their overall thrust, the results of this study coincide with those of the studies conducted by Statec in suggesting that the central role of research into finding indicators linking the use of ICT in firms with the delivery of innovation must involve measures of intensities of ICT utilization, organizational e-readiness, and the various forms of innovation.

## **Methodological note**

Eleven organizations were canvassed for this study. These organizations were chosen because they had innovated using information and communications technologies.

The case studies covered the period between the fall of 2010 and the summer of 2011.

The sample of organizations was eclectic. It included organizations from the public and the private sector. Some organizations were in the manufacturing sector, while others provided services. Some of the innovations examined were sweeping, others more incremental. Their impact ranged from modest to far-reaching.

The ICT utilized to innovate are extremely varied. They involve both “traditional” technologies to computerize and optimize processes and more recent technologies such as Web 2.0. As one might expect, Internet use is ubiquitous.

Most of these organizations were based in Quebec, but some were elsewhere. Nothing in the information we gathered suggests that the results obtained from innovations could not be extrapolated to other geographical locations.

We extend our sincere thanks to the organizations that participated.

## Appendix

**List of ICT** (adapted from “Les TIC en 2006,” number I-2007, STATEC, <http://www.statec.public.lu/en/>)

	Sample (%)	Population (%)
<b>LAN (Local Area Network)</b>	97	99
<b>E-mail</b>	95	93
<b>DSL Connection</b>	74	74
<b>Website</b>	70	66
<b>Electronic calendar</b>	42	30
<b>Extranet</b>	37	28
<b>Mobile Connection</b>	29	21
<b>Group project manager</b>	28	15
<b>ISDN connection</b>	28	28
<b>Free software</b>	26	14
<b>Digital signature</b>	22	14
<b>Video conferencing</b>	20	9
<b>Forum</b>	19	9
<b>Modem</b>	16	14

<sup>i</sup> Economist Intelligence Unit (2010), Digital economy rankings 2010 Beyond e-readiness, 26 pages.

<sup>ii</sup> In order to safeguard the respondents' anonymity and confidentiality and the strategic positioning of the firms participating in the study, this report only discusses the conclusions yielded by the case studies. Details of each firm's innovations are not revealed.

<sup>iii</sup> OECD (2004). The Economic Impact of ICT – Measurement, Evidence and Implications, OCDE, Paris.

<sup>iv</sup> ICT, Innovation and perceived effects in Luxembourgish firms, Leila Ben Aoun, Anne Dubrocard, CRP Henri Tudor & Statec & Observatoire de la Compétitivité, Economie et Statistiques, Statec, No. 50, December 2010

<sup>v</sup> For a more detailed discussion of these changes, the reader is invited to consult: Aubert B., Cohendet P., Da Silva L., Grandadam D., Guimaron J., Montreuil B., “L'innovation et les technologies de l'information et des communications,” published simultaneously by CEFRIO and le Centre sur la productivité et la prospérité de HEC Montréal, October 2010.