A Framework for Evaluating Strategic Location-Based Applications in Businesses

François Bergeron,[1,3] Lin Gingras,[2,3] Claude Caron[2,3]
[1] Faculté des sciences de l'administration
Université Laval
Québec, G1K 7P4

[2] Faculté d'administration   [3] Geobusiness Group
Université de Sherbrooke   Université de Sherbrooke
Sherbrooke, J1K 2R1   Sherbrooke, J1K 2R1

To this day, very few information technologies have both a strategic impact on organizations and an important location dimension. After briefly reviewing these technologies, this paper focuses on the dimensions that must be taken into account by firms before implementing these information technologies and proposes a grid for analyzing their strategic impacts and their contribution to the strategic direction of organizations.

Current Trends in Location-Based IT and Their Impacts on Organizations

Three information technologies, ubiquitous or pervasive computing, mobile and wireless networks, and location-based technologies are presently making very rapid strides and bringing important and continuous changes in today's organizations (Sieworek 2002; Borriello et al 2005). The location-based applications and technologies discussed in this paper are at the intersection of the three sets of technologies presented in Figure 1.
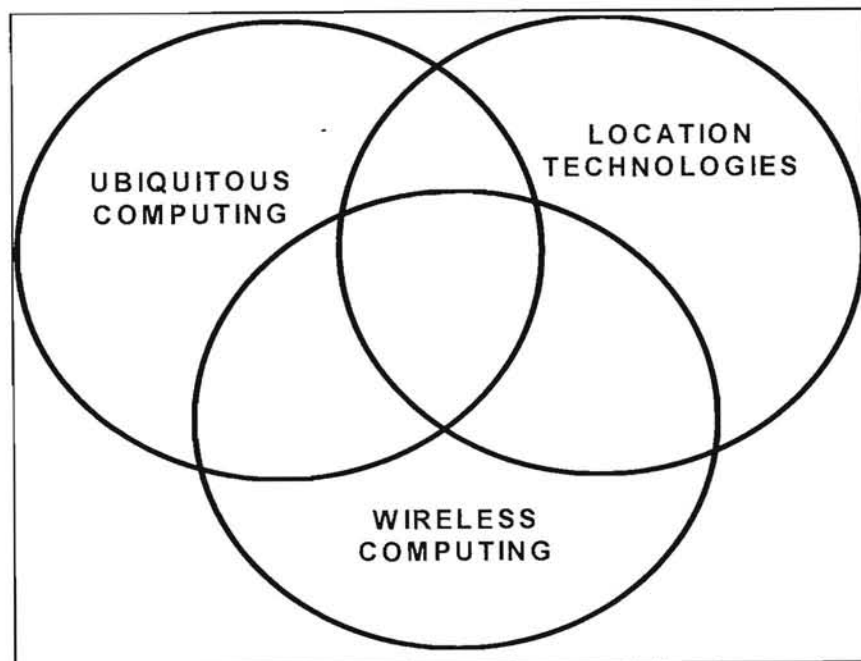
FIGURE 1 Technology Intersection

Ubiquitous computing: Ubiquitous computing, sometimes described as pervasive computing, is the new state of technologies that are ever present and always available in today's business environment. Be it by wire or wireless, portable communications, desktop, portable computers or PDA, computer processing power and information is always available to the decision maker. Ubiquitous computing is redefining the client-business relationship: businesses can now know their customers' and suppliers' location and their preferences. In this way, they are becoming more capable of satisfying their business partners needs, which will allow them to maintain deeper and more profitable business relations.

Mobile communications and wireless networks: In recent years, there have been tremendous strides in mobile and wireless communications technologies Portable telephones, RFID (Radio Frequency Identification) and wireless local networks have penetrated the business environment and have changed the way people in organizations communicate, get their information and manage people.

Location based technologies: Technologies such as ubiquitous computing and mobile and wireless communications integrate location among their characteristics (Korkea-aho et al 2002; Gingras et al 2004). These technologies allow managers to locate the users, locate the personnel, locate the customers and locate the goods received, in production or being delivered. This location information is created by using geomatics technologies such as GPS, RFID or by capturing the location of personnel, goods or services rendered at the source at the same time as the transaction occurs.

The Impacts of Location-Based Technologies on Organizations

Groups in Organizations

All these portable and location-based applications and technologies are having significant impacts on businesses. Ubiquitous computing supports activities in environments that are physically distributed and brought closer to the customers and operations. Intra and inter enterprise wireless networks radically change the way companies and organizations are managed (Rist 2003). Since managing an organization is a group activity, and since location-based technologies change the concept of a group (for instance, geographically dispersed, moving persons) they create organizational groups that are very different from the groups that are used as the basis of current management thinking. The concept of group as it is known in current organizations -- a common physical space, connected by wire with well-known social behaviours -- will not be one of the characteristics of the modern organizations anymore. Decisions in an organization taken by geographically distributed groups create a need for applications that will make it possible for participants to obtain contextual information such as information on the physical environment of the members of the group.

Risks Involved

By observing various organizations that adopted and implemented location-based applications and geomatics technologies over the last few years, we can highlight three main findings. First, location-based IT (information technology) is evolving towards thinner, lighter (e.g., cartography on the Web) and often mobile applications (e.g.: PDA with GPS receiver and charts and maps). Second, the businesses areas and the types of users that use these location-based ITs are diversifying, particularly in eBusiness environments. It is important for location-based technology to be adapted in terms of availability, accuracy and continuity so as to prevent failures of applications. Third, the systems resulting from the implementation of these location-based ITs within firms do not always bring the anticipated benefits.

Indeed, even though press releases and the business literature in general mainly highlight "success stories", several reports indicate that a large percentage of location-based IT implementations end up as business failures with significant financial losses. Badly defined objectives, actors with little interest, missed opportunities, weak strategies, lack of benefits, and unused systems are among the numerous factors that can explain implementation failures. And, even though we notice continuous improvements in the implementation process of location-based systems, it still remains very difficult to evaluate the fit between new location-based technologies and a firm's business strategy (Caron and Bédard 2002).

Business Processes

The implementation and use of location-based technologies can have a significant impact on firms' business processes (Fano and Gershman 2002):

- The location of the customer becomes the location of the enterprise;
- A physical presence everywhere the product or service is generated by the business emerges as a strategic necessity;
- Mobile and portable tools become the eyes and ears of distance service providers; and
- Mobile tools are supporting location-based services in sectors such as travel, banking and insurance.

Access to Data

Ubiquitous computing allows decision-makers and knowledge workers to have a much larger access to data and specialized applications. Pervasive computing technologies make it possible to access transactions at the moment they occur, from any location. The limitations tied to the physical office and traditional working hours disappear. The decision-makers can have access to whole and complete information from any place, any anytime. As such, ubiquitous computing allows the continuous monitoring of goods and services.

The value of ubiquitous computing for a decision-maker depends on his or her location. Decision-makers who must obtain information from multiple individuals, processes and locations should benefit from this innovation in an important way. The necessity to maintain a workplace and its business hours impose serious space and time constraints on the decision maker. These space and time constraints disappear with ubiquitous and pervasive computing, since the technology makes it possible to move the functions of the office closer to the decision-maker (Davis 2002).

Disruptive Changes

Location-based technologies are bringing disruptive changes to the way business is conducted since they create discontinuities in processes. They change the nature of work and create new opportunities for managers and their firms by integrating more intelligence in the decision process, reducing decision time and bringing more user orientation in business approaches (Cheverst et al 2002). However, disruptive location-based technologies and applications, by creating opportunities for change in businesses, can help firms gain a competitive advantage. In that sense, introducing these disruptive technologies means introducing strategic components into an organization.

The examples presented above show how the use of location-based technologies and applications can provide firms' with an opportunity for strategic advantage. Hence there is a need for tools to analyze the strategic fit between location technologies and applications and the overall strategic plan of the business. The following sections describe this alignment process and present a tool to support this analysis.

Strategic Analysis of Location-Based Technologies in Organizations

Organizations must make strategic choices when they develop and implement computer applications. To our knowledge, there is currently no tool available to decision-makers to help them take into account the various risks of development and understand the strategic advantages related to location-based applications in businesses. The following sections present a framework for the strategic integration of these technologies in organizations. The benefits and impacts of location-based technologies are presented in the first section while the second section addresses the concept of strategic alignment.

Location-Based Technologies and their Benefits

Location-based technologies can provide significant benefits to firms. These benefits can be grouped along three dimensions: operational, managerial and strategic. Like every new technology, they also generate a whole set of risks which should be taken into account.

Operational benefits

The use of location-based applications brings several types of operational benefits to firms. For example, they make it possible to increase the quantity of data produced at the time a transaction occurs. They also generate a higher quality of information; as this information is more precise at the time of the gathering, it can be validated at once by the system, and is transmitted without error from computer to computer for greater safety and integrity. Information transmission delays are also improved. Indeed, data can be transmitted at the time of gathering without delay or latency. Operational costs can also be reduced significantly as demonstrated by firms using location-based technology to manage their trucking operations.

Managerial benefits

A second category of advantages relates to managerial control improvements. When integrated into the business processes, location-based applications bring several benefits to the firm. In this sense, location-based technology projects can bring interesting benefits insofar as they were evaluated beforehand, not only on their direct but also on their indirect costs and by comparing them with the quantified monetary benefits they generate. The display of location associated with relevant business information through appropriate software could bring significant benefits to the business. Location-based technology projects can also provide intangible benefits to firms. Once this stage of project assessment is completed, some location-based applications can also help with products lifecycle management, both at the assembly level in a factory and the subsequent stages of the value chain such as the distribution and sales activities. The RFID applications presently being developed and implemented give rise to these benefits.

Strategic benefits

Contrary to operational and managerial benefits, the strategic benefits tied to the use of location-based systems are harder to realize. However, when applications are adequately identified, they allow a firm to be better positioned on the market, to offer new products, to increase its number of customers, to increase its market share, to accelerate its sales growth and to increase its profitability.

In the end, any large location-based implementation, like any major data-processing project, must contribute to the net income of the organization. This objective is realistic only if the innovation allows a firm to offer a new service to its customers, to better support its suppliers, to eliminate competition by a judicious choice of application, or to prevent the arrival of new competitors on the market. The integration of the location–based information produced with internal and external value chains of the organization by the creation of privileged linkages with its customers, suppliers, distributors and/or government agencies will help a firm to obtain these strategic advantages.

The Importance of Strategic Alignment for Project Success

The strategic alignment of location-based projects is essential for their success. By strategic alignment, one understands the co-alignment of the organizational strategy with that of information technology as well as the co-alignment of the organizational structure with the structure of IT (Croteau and Bergeron 2001). It is indeed only when these dimensions are co-aligned that a company can hope to realize the business benefits tied to the investments in location-based technology and applications.

Defining business strategies

There are several different definitions of what is a business strategy. There is the concept of desired strategy as opposed to effective strategy, i.e. what the organization aims to realize versus the strategy that the organization really carries out from day to day. There is also the approach to market strategy developed by Porter (1990), which essentially stipulates that a company has the choice between three possible strategies: costs, differentiation, or niche; but we know now that these three strategies are not exclusive. Also present in the business strategy literature is the strategic type: Prospector, Analyst, Defender, Reactive (Miles and Snow 1978). One also finds the hierarchy of strategies: the vision, the general strategy (of the company), the operational strategies (of divisions) and the tactics of the operational units) (Johnson and Scholes 1999), and many others. All these classifications of strategies have their usefulness but we prefer the concept of strategic orientation (Venkatraman 1999) which has the advantage of making explicit the intensity of strategic actions carried out by the organization.

According to the intensity of strategic actions concept, it is possible for an organization to execute various types of strategic actions. The organization can analyze its position on a market, choose the appropriate action and take precise actions. The intensity of strategic actions relates more to the effort that is made by the organization to choose and establish its strategy than with the type of action itself. For example, a company with a strong strategy carries out many strategic studies and implements the results of its choices whereas a company with a weak strategy carries out relatively few studies and implements few actions rising directly from these choices. To attain a higher financial performance than its competitors, a company must have a strong strategy. In a location-based application context, the organization that will try a greater number of location-based applications will have a stronger strategy and should then realize more benefits.

Location-Based Applications Strategy

The IT strategy of an organization is composed of two main dimensions: first, the environmental scanning of IT, including location-based technologies and applications, and second, the strategic use of these applications.

Environmental scanning of location-based IT

The environmental scanning dimension of IT relates to the actions an organization conducts to acquire expertise on available location-based information technology and applications, and their use within its industrial sector, including competitors. The environmental scanning must therefore be a permanent activity. For example, an organization must know what application-based technologies its competitors use: are they using wireless applications? Do these applications locate the

customer by radio tagged items in certain areas of its business site? Technological scanning allows the survival of organizations facing their competitors through the use of new technological levers like location-based applications.

The strategic use of location-based applications

The strategic use of location-based applications relates mainly to the return on investment and profitability tied to the use of the technology. It thus include, among other things, the use of IT to reduce the production costs, to increase the productivity of the firm, to respect promised delivery dates to customers, and to increase the net income of the enterprise. For example, by using location-based applications, Dillard's who was facing intense competition from other stores, was able to identify the location of its customers at the store level rather than only at the regional level, which in turn increased its merchandise turnover and generated a much better financial performance (Duvall 2003).

In order for the firms to realize these benefits, their information technology strategy must be strong and aligned to their overall business strategy, by either being the working tool of the strategic analysts or the data-processing tool used to carry out the strategic actions of the organization on a daily basis. Information technology benefits the organization only when the IT strategy is strong, and when it supports a strong organizational strategy. Businesses whose IT strategy is weak, will invest lost funds in location-based technology and applications, and this situation must be avoided.

The Organizational Structure

For a small or medium-sized business, the quality of the organizational structure includes the level of structure of its tasks, the specialization of the workers and the number of hierarchical levels. For service firms, the level of professionalism (professional staff) is added whereas for manufacturing organizations, the level of centralization is important. The organization that has at least three hierarchical levels, (i.e., the general managers at level 1, level 2 being the specialized staff and at level 3, the workers), within which tasks are clearly defined and whose workers are specialized, profit more from IT and location-based technologies than organizations that do not meet these criteria (Bergeron et al 2001). The quality of the organizational structure is thus important.

The Structure of the Location-Based Applications Environment

The structure of the IT environment and of location-based applications spans two dimensions: the first includes the planning and the control of information technology whereas the second relates to the acquisition and implementation of IT. These two dimensions correspond to the structure of the overall information

technology management process. It should be noted that we do not analyze the structure from the data-processing viewpoint, i.e. the data-processing architecture, the applications and the data, nor from the organizational viewpoint, i.e. from centralized, distributed or decentralized data processing structure, because these structures are of secondary importance relative to the need for a structured process for managing information technology and location-based applications.

Planning and control activities

Planning and control activities relate to a whole set of elements specific to information technologies but seen from the perspective of the top executives of the firm. This dimension thus relates to the managing of current technology products, the control of any project implying IT and location-based applications, the capacity to identify information technology requirements and to find location-based applications solutions, the planning of any data-processing project, including location-based projects, in relation to business objectives, and the development of a technological culture.

Acquisition and development activities

Acquisition and control of IT activities require a structured approach for evaluating projects. This approach uses specific evaluation criteria and tools for financial analysis. It includes an *a priori* evaluation of the impacts of a new technology on the personnel of the firm and the organizational changes they will bring about. Finally, it elaborates the contributions of this technology to attain organizational objectives and identifies the problems which it could generate.

For a location-based application implementation to be a success it is thus essential not only that the structure of the company be sufficiently developed, but also that the structure of the IT environment be adequately managed. It will be difficult for an organization with little structure to know how to manage its information technology adequately. In these situations, it is often the case that computer-based applications are not profitable for the organization. Obviously, in low structure environments, one cannot implement a solution without risks because it requires important organizational changes along a steep learning curve. This alignment of structures, coupled with the alignment of the strategies, as well as the cross alignment of strategies and structures is the keystone for profitable computer-based applications.

Organizational Performance and Strategic Alignment

The benefits of strategic alignment result in increased performance for the organization. This performance rests upon two dimensions: growth and profitability. Growth includes an increase in sales, in market share and in consumer base whereas profitability is measured by an increase in sales, in return on capital, and in earnings per share.

The alignment between strategies and structures makes it possible for data-processing projects to maximize the chances of success measured by the performance of the organization. In fact, this alignment is very important because we previously observed that organizations that show a weak alignment are the least profitable firms. Location-based application projects, as other computer-based projects, must undergo the same rigorous evaluation, the same attention from management and the same strategic alignment that other computer-based projects receive. These requirements will be beneficial and advantageous because, in the long run, they will make it possible for individuals to better use location-based applications. The organizational performance criterion is the ultimate evaluation for success. The grid presented in the next section applies to both large and small organizations.

Location-Based Application Opportunity Indicator

Location-based applications can provide firms with a competitive advantage just as traditional IT applications can. For this reason, various approaches can be used to identify location-based applications opportunities. Indeed, the value chain approach by Porter is the most appropriate for manufacturing organizations whereas Wiseman's model gives better results for service organizations (Bergeron et al 1991). To support these approaches, we propose a grid for evaluating location-based applications projects, which we call the GEOGRID. This grid helps to select the most promising projects for an organization, and thus to decrease risks and increase performance.

The GEOGRID for Evaluating Location-Based Applications Opportunities

GEOGRID makes it possible to evaluate location-based applications opportunities within an organization. It includes three main dimensions: the benefits, the strategy and the structure. The benefits must be positive, the strategy must maximize the intensity of the strategic actions and the structure must be sufficiently developed to support strategy (see Table 1).

Implementation Steps

The use of the GEOGRID by firms involves the following three steps:

- **Knowledge of the organization:** First, the organization strategy needs to be identified. During this step, the organization must specify its vision, objectives, product/service mix, financial performance requirements, growth and market share objectives. The actual organizational strategy implemented to attain these goals is assessed by rating the intensity of each type of strategic actions (aggressive, proactive, analytic, defensive, future).

TABLE 1 GEOGRID

Benefits	Strategy
Operational benefits	**Business strategy (strategic actions)**
Increase in quantity of relevant data	Aggressive (cutting prices to get market share)
Quality of data improved (specific, up to date, complete)	Proactive (new products/markets)
Validation of data at source	Analytic (leveraging trends)
Transmission without error	Defensive (minimum costs to safeguard market)
More precise location	Future (forecasting future actions)
Improved cartography	
Shortened transmission time	
Better data security	**Location-based applications strategy**
Reduction of field action delay	Environmental scanning activities in IT and location-based technologies
Greater integrity of data	Strategic use of IT and location-based applications (concrete contributions)
Lower direct costs of production (labor and material)	
Managerial benefits	**Structure**
Lower indirect production costs	
Faster intervention and lower losses	**Organizational structure**
Lower total cost of production (i.e., lower losses on products)	Formalization (documentation of tasks, procedures)
More efficient use (follow-up and control) of field human resources	Specialization (specific tasks)
Improvement in CRM database (intangible)	Differentiation (number of hierarchical levels)
Better integration of the ERP in the value chain (intangible)	
	Location-based structure
Strategic benefits & org. performance	Planning and control (structure of planning systems/ control)
More customers	Acquisition and development (hardware, software, networks)
Increased satisfaction of local customers	
Increased product/service sales	
Growth of the organization (sales)	
Increased profits	
Lower production costs than direct competitors	
Development of a competitive advantage	

As for the structure of the firm, it is important for a business to rely on a well-developed structure supported by a specialized staff, in order to support the organizational and IT strategies, including location-based applications. This assessment must show that this type of personnel is available.

The IT structure is then identified. This step can be done through an audit type of intervention, where each element listed in the GEOGRID has to be identified and detailed. The auditor assesses the adequacy of the IT planning, control, acquisition and development phases. These phases provide a structure to the IT management function.

- **Definition of the IT strategy:** During this step, the organization assesses the IT function necessary to support the business strategy and its contribution to each type of strategic actions. In addition, environmental activities in IT and

location-based technologies are assessed, as well as the actual and potential contribution of the strategic use of IT and location-based applications. If an organization has no specific IT location-based application, potential applications can be found during brainstorming sessions where, for example, managers assess which location-based application could be implemented to support each step of the value chain.

- **Evaluation of existing applications and opportunities:** The third and last step can be accomplished by evaluating the potential contribution of each application to reach operational, managerial and strategic benefits. A prioritization of the opportunities can be made based on the matching of IT applications and organizational strategy, the projected benefits, the time needed to complete the project and the likelihood that it will be successfully completed on time, within projected costs and meet users requirements. Special care should be taken to ascertain the adequacy of the IT structure to support project implementation (e.g., support should be from the President/CEO down to analysts/users).

Summary

Location-based technologies and applications represent a very powerful technological breakthrough for firms. Investments in location-based technologies help the creation of new companies and open new markets by helping managers to obtain more from data and personnel of their organizations. These location-based projects must be developed in positive organizational contexts while being supported by top management. They will then have the best chances of success while decreasing their associated risks. This paper has highlighted the need for structured analysis of location-based technology projects, proposing the use of the GEOGRID framework, and detailed the prerequisites necessary for successful implementation and use.

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