



## A Primer on Risk Management

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## Basic Principles of Risk Management

As reported in 2004 by Standish Group Inc.,<sup>1</sup> projects that implement information technologies remain inherently risky, with 18% of information technology (IT) projects failing and 53% meeting only limited success.<sup>2</sup> This means that approximately 70% of projects do not meet their objectives. Moreover, the greater the potential benefits associated with this type of project, the greater the potential negative impacts if the project fails. This is why project risk must be managed.

**The problem:** There are many ways in which an IT project that does not fulfil its objectives can result in losses. These losses will be in the form of tangible or intangible costs that the unit in question—a business unit, a company, a department or a government—must assume.

**The concept:** Managing risk requires first making an assessment of the project's risk exposure. This depends on the impacts associated with potential undesirable outcomes and the probability that each of these outcomes will occur.

Undesirable outcomes occur when the completed project has fallen short of its objectives. Undesirable outcomes result in losses for the organization in the form of tangible or intangible costs that must be assumed by the organization. For example, a project may have provided the desired results in terms of system functionality but at a cost that is much higher than expected. Conversely, a project may have been delivered on time and within its budget but not provided the intended functionalities.

Risk factors are project pitfalls that can influence the probability that an undesirable outcome may occur. These factors may be endogenous, such as the project's size or a lack of resources, or they may be exogenous, such as the regulatory or economic environment.

Risk exposure is the expected loss associated with an undesirable outcome, that is, the probability of an undesirable outcome combined with the seriousness of its impact. Risk exposure may be represented graphically, using one axis for the probability of occurrence of an undesirable outcome and the other for its seriousness. A given degree of risk exposure then falls into one of three zones:

- High exposure when an undesirable event has both a high probability of occurrence and a significant impact on the project (cost to the organization),
- Low risk exposure when an event has a low probability of occurrence and a small impact on the project, and
- Moderate risk exposure when an undesirable event has a high probability of occurrence but a small impact or when it has a low probability of occurrence but a significant impact.

**Method:** Managing project risk involves first making an assessment of the project's risk exposure and then developing action plans to reduce the risk. Assessing risk exposure requires:

- Estimating the scope of the problems that the organization may face in a project,
- Generating a map of risk exposure using the table of links between undesirable outcomes and the various risk factors (lists of risk factors have been proposed in the literature for diverse types of projects such as ERP implementation<sup>3</sup> and outsourcing of information systems services<sup>4</sup>) and
- Developing a table of existing links between the undesirable outcomes and the risk factors.

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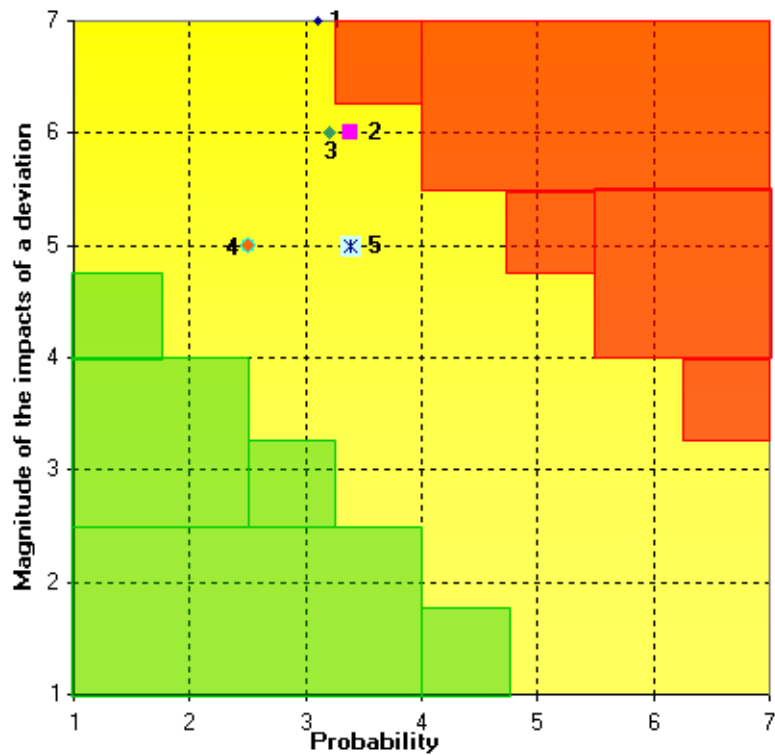
<sup>1</sup> Source: "2004 Third Quarter Research Report," Standish Group International Inc.

<sup>2</sup> Having exceeded their budgets or possessing fewer functionalities than expected.

<sup>3</sup> Jean-Grégoire Bernard, "La mesure du risque d'un projet d'implantation de progiciels de gestion intégrée," Masters thesis, (M.Sc.), HEC, July 2002.

<sup>4</sup> Aubert, B.A., Patry, M. and Rivard, S., "Gérer le risque lié à l'implantation des technologies de l'information," *Gestion – revue internationale de gestion*, Vol. 28, No. 4, 2004, p. 37 - 51.

With a given level of anticipated benefits, managing a project's risk involves reducing the project's risk exposure to an acceptable level, ideally to the first quadrant of Figure 1, where risk exposure is low. There are two ways to achieve this goal: reducing the seriousness of the impact of one or more undesirable outcomes and diminishing the probability that one or more undesirable outcomes will occur. Insurance is a mechanism of the first type; even if it does not reduce the probability of a fire, when you insure your home you are using a risk management mechanism, since you reduce the financial impact of a fire in your home. On the other hand, safe storage of dangerous materials and the installation of a lightning rod are measures that reduce the probability of a fire occurring.



**Figure 1: Zones of Risk Exposure**

## Application: Managing Risk in an ERP Project<sup>5</sup>

ERP projects offer many benefits (reduced costs, improved productivity and customer service, better resource management, etc.) and have become increasingly common. These ventures still carry significant risks, however; many projects have had to be abandoned or have resulted in considerable losses.

**The problem:** The scale of most ERP applications and their many interfaces with existing systems within the company makes any implementation project a potential source of losses. These losses take the form of costs that must be borne by the company.

**The concept :** Risk management requires first making an assessment of the project's risk exposure, which depends on the impacts of potential undesirable outcomes and the probability that each of these outcomes will occur. Risk management consists of reducing the project's exposure to these risks, to bring exposure to an acceptable level. In order to succeed, either the seriousness of the impacts of these outcomes or their respective probabilities must be reduced.

The main undesirable outcomes are those areas where a project falls short of meeting its objectives. They have been identified through a review of the literature and case studies. The main undesirable outcomes are: a poor-quality system, budget overruns, the project not being delivered on time, poor system functionality, and dissatisfied users. This is not, however, an exhaustive list. Potential undesirable outcomes may differ from one project to another, since they reflect project objectives that were set before the implementation began.

The risk factors are any potential pitfalls that could affect the probability of an undesirable outcome. A review of the literature and of case studies revealed 11 risk factors (a detailed list has been provided in Table 1 in Appendix A):

- *Newness of technology:* comprises the risk inherent in the scope of changes brought by new software and/or computing equipment, etc.
- *Project size:* concerns the impact of a series of different aspects of project size (number of users in the organization and the size and range of expertise on the implementation team).
- *Experience and expertise:* includes the skill sets on the project team, both in software implementation and project management / change management. The expertise and experience of members of the internal team of the internal project and the experience and expertise of the contracting parties are assessed as two distinct risk factors.
- *System complexity:* covers the technical complexity of the system (software complexity, interoperability) as well as the importance of links to existing (or future) systems in the organization.
- *Complexity of the organization's target processes:* comprises the complexity of tasks and the interdependence of processes (Do processes involve several departments? Are they supported by more than one software program?).
- *Organizational environment:* concerns resources available for the project, the general climate in the organization, and the degree of cooperation and amount of exchange between departments.
- *Quality of the software package:* covers technical aspects of the software being implemented.

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### <sup>5</sup> Sources:

- (1) Bernard, J.-G., "La mesure du risque d'un projet d'implantation de progiciels de gestion intégrée," Masters thesis (M.Sc.), HEC Montréal, July 2002.
- (2) Bernard, J.-G., S. Rivard and B. A. Aubert, "L'exposition au risque d'implantation de ERP: éléments de mesure et d'atténuation," *Cahier de la Chaire de gestion stratégique des technologies de l'information*, No. 02-06, November 2002.
- (3) Bernard, J.-G., S. Rivard and B. A. Aubert, "Évaluation du risque d'implantation de progiciels," *Project Report No. 2002RP-15*, CIRANO, September 2002.

- *Gap between the processes supported by the software package and the processes targeted by the organization:* refers to the gap between the software package's functional features and the features sought by the organization (percentages of abandoned functionalities, etc.).
- *Strength of the software supplier:* covers several variables (financial stability as well as experience and expertise in implementations of this size).
- *Cultural gap:* refers to the compatibility of the corporate cultures – the culture of the client organization and that of the integrator (contractor). Misunderstandings can create problems in the implementation of a software package.

The project's risk exposure is the probability that an undesirable outcome will occur combined with the seriousness of its impact. This exposure may be represented graphically, using one axis for the probability of occurrence of an undesirable outcome and the other for its seriousness. A given risk exposure then falls into one of three zones:

- High risk exposure when an undesirable event has both a high probability of occurrence and a significant impact on the project (cost to the organization),
- Low risk exposure when an event has a low probability of occurrence and a small impact on the project, and
- Moderate risk exposure when an undesirable event has a high probability of occurrence but a small impact or a low probability of occurrence but a significant impact.

## Method

- Identify the project's potential undesirable outcomes and determine the seriousness of their impact on the organization.
- Develop a table of the existing links between the risk factors and the undesirable outcomes (see Table 2 in the Appendix A).
- Develop a map of risk exposure from the table of links between undesirable outcomes and the various risk factors found in a review of the literature.<sup>6</sup>
- Manage project risk<sup>7</sup> by intervening to reduce the project's risk exposure to an acceptable level, i.e. a low level. This can be achieved either by reducing the seriousness of the impact of undesirable outcomes or by reducing the probability that undesired outcomes will occur.

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<sup>6</sup> (1) A list of these links, derived from a review of the literature and case studies, is provided in Appendix B.

<sup>7</sup> Aubert, B.A., Patry, M. and Rivard, S., "Gérer le risque lié à l'impartition des technologies de l'information," *Gestion – revue internationale de gestion*, Vol. 28, No. 4, 2004, p. 37 - 51.

## Appendix A: Tables

**Table 1: Components of Risk Factors**

Risk Factors	Components
1. New technology	<ul style="list-style-type: none"> <li>- Need for new computer equipment</li> <li>- Need for new software</li> </ul>
2. Project size	<ul style="list-style-type: none"> <li>- Number of persons on the project team</li> <li>- Number of system users</li> <li>- Number of person-days required for system development</li> <li>- Length of the project (in number of months)</li> <li>- Estimated project cost</li> </ul>
3. Experience and expertise	<ul style="list-style-type: none"> <li>- Lack of expertise in the methodology</li> <li>- Lack of expertise in the technology</li> <li>- Lack of experience on the team in the ways of the organization</li> <li>- Lack of experience among users and lack of user support</li> <li>- Dependence on key system users</li> </ul>
4. System complexity	<ul style="list-style-type: none"> <li>- Technical complexity</li> <li>- Number of interfaces with existing systems</li> <li>- Number of interfaces with future systems</li> </ul>
5. Complexity of the organization's target processes	<ul style="list-style-type: none"> <li>- Complexity of the tasks (Are they standardized?)</li> <li>- Process interdependence (Do the processes span several departments? Are they supported by different programs?)</li> <li>- Standardization (an assessment made one process at a time)</li> <li>- Number of business units involved</li> <li>- Extent of geographical dispersal of processes</li> </ul>
6. Organizational environment	<ul style="list-style-type: none"> <li>- Scope of changes introduced by the system</li> <li>- Insufficient resources</li> <li>- Intensity of conflicts (general climate in the organization)</li> <li>- Lack of clarity in the definition of roles</li> <li>- Amount of interdepartmental cooperation</li> <li>- Lack of commitment within the project team</li> <li>- Lack of commitment on the part of upper management</li> </ul>
7. Quality of the software package	<ul style="list-style-type: none"> <li>- Reliability</li> <li>- Effectiveness</li> <li>- User friendliness</li> <li>- Ease of use for developers</li> <li>- Understandability</li> <li>- Verifiability</li> </ul>
8. Poor match between the software package's processes and the processes targeted by the organization	<ul style="list-style-type: none"> <li>- Size of the gaps in functionality</li> </ul>
9. Strength of the software publisher	<ul style="list-style-type: none"> <li>- Publisher's financial stability</li> <li>- Publisher's lack of experience and expertise with implementations of the software package</li> <li>- Size of the publisher</li> </ul>
10. Integrator's expertise and culture	<ul style="list-style-type: none"> <li>- Lack of expertise in the methodology</li> <li>- Lack of expertise in the technology</li> <li>- Lack of experience in the ways of the organization</li> </ul>
11. Cultural appropriateness	<ul style="list-style-type: none"> <li>- Importance given to tasks and outcomes</li> <li>- Whether the organization is focused on employees or on the work</li> <li>- Whether employees identify with the organization or with their area of expertise</li> <li>- Whether the organization is oriented towards its environment or turned inwards</li> <li>- Whether the organization exercises tight control or takes a more flexible approach</li> </ul>
<p><i>Source:</i> Bernard, J-G., S., Rivard, and B. A., Aubert, "Évaluation du risque d'implantation de progiciel." <i>Rapport CIRANO No. 2002-RP15</i>, CIRANO, Montréal, August 2002.</p>	

**Table 2: Links Between Risk Factors and Undesirable Outcomes**

<b>Risk Factors</b>	<b><u>Undesirable Outcomes</u></b>				
	<b>1 – Budgets Overruns</b>	<b>2 – Late Delivery</b>	<b>3 – System of Poor Technical Quality</b>	<b>4 – Poor System Functionalities</b>	<b>5 – Dissatisfied Users</b>
1. New technology	√	√	√		
2. Project size	√	√			
3. Experience and expertise	√	√	√	√	√
4. System complexity	√	√			
5. Complexity of the organization's target processes	√	√			√
6. Organizational environment	√	√			√
7. Quality of the software package	√	√	√		
8. Poor match between the software package's processes and the processes targeted by the organization				√	√
9. Strength of the software publisher			√	√	√
10. Integrator's expertise	√	√	√	√	√
11. Cultural discrepancies		√			√

Legend: √ = Presence of a link of influence between the undesirable outcome and the risk factor

Source: adapted from Bernard, J.-G., Rivard, S. and Aubert, B.A., "L'exposition au risque d'implantation de ERP: éléments de mesure et d'atténuation," *Systèmes d'information et management*, Vol. 9, No. 2, 2004, p. 25 - 50.

## Risk Management in an ERP Implementation – The Hydro-Quebec “Projet Harmonie”<sup>8</sup> -

**The problem:** In 1997, Hydro-Québec<sup>9</sup> began implementing the SAP R/3 software package to replace most of its older systems. This project would have an impact on several departments: accounting, capital asset management, procurement, vehicle maintenance, training management, human resources management, payroll services and building management. Given specific characteristics of Hydro-Québec, the failures it had experienced in the past with ERP implementations and its business culture, this change represented a high-risk venture. For these reasons, Hydro-Québec engaged a consortium of integrators (Deloitte & Touche – ICS Consulting Group, PriceWaterhouse / Omnilogic and Systematix).

**The concept:** In this case, risk management consisted of introducing mechanisms that would reduce the project's risk exposure<sup>10</sup> to an acceptable level.

### The practice

The undesirable outcomes, as identified by J-G Bernard (2002), would be:

- Budget overruns: the project budget was \$125 million (in Canadian dollars);
- Not delivering on time: the project would run 30 months, and the final deadline, in the year 2000, was firm;
- Any compromise to the quality of the final system; and
- Dissatisfaction among the users: the project would affect close to 6,500 users.

### Risk factors:

- *New technology:* The SAP 3/R system would replace approximately 200 existing computer systems. This would require changing the existing environment (which was based on central computers) to a client/server environment, installing a new telecommunications system and deploying the Windows 95 operating system on all the users' computers. These were major changes, and they involved converting several very large and fragmented data files throughout the organization (Landry, R. and Rivard, S., 2001, p. 60). In other companies, the complex work required to integrate data and make it uniform had become a major obstacle.
- *Project size:* As pointed out by Landry and Rivard (2001), this SAP R/3 implementation was one of the largest ever attempted in North America. The project required close to 95,000 person-days to complete. The project team was very large, had several sub-teams<sup>11</sup> and was notable for the diversity of experience and cultures among its members.
- *Lack of internal expertise:* The project team consisted of people from the various administrative units affected by the project. This team had extensive knowledge of the company's processes, but it had

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### <sup>8</sup> Sources:

Bernard, J-G, 2002, “La mesure du risque d'un projet d'implantation de progiciels de gestion intégré,” Masters thesis, HEC Montréal and

- Landry, R., Rivard, S., “Le projet Harmonie,” *Gestion*, Vol.25, No.4, 2001, p. 56-64.

- Rivard S., “Entrevue avec Serge Potte, directeur du projet Harmonie,” *Gestion*, Vol.25, No.4, p. 57-63.

- Bélanger, J., “Les défis de l'implantation d'un progiciel intégré,” p. 67-69.

<sup>9</sup> A company active in the energy sector with assets of close to \$60 billion, annual sales of \$11.4 billion and 20,676 employees, more than 70% of whom were unionized.

<sup>10</sup> Risk exposure is the probability of an undesirable outcome combined with the seriousness of its impact. It may be represented graphically, using one axis for the probability of occurrence of an undesirable outcome and the other for its seriousness.

<sup>11</sup> A management team made up of four process teams, a technology team, a training team and an integration and control team.



no experience with the technology that was being implemented (SAP 3/R and a client/server platform).

- *System complexity*: The large number of interfaces needed between the software package and the existing systems that would remain after the implementation was perceived to be a major issue (Bernard, J-G, 2002, p. 117).
- *Organizational environment*: The scope of the changes brought upon the organization had an impact on the users' tasks and responsibilities, which were transformed by the technology but which did not necessarily become easier. "In fact, all the accounting concepts would be transformed to the point that the users of financial information throughout the company could effectively be made illiterate overnight. The business practices supported by the ERP could also represent a significant loss of skills if the changes are not well managed. In addition to wreaking havoc on peoples' skill sets, this kind of project modifies relationships between business units because of the integration. More transparency is required, which creates interdependence between functions. In the process, a light is shone on everyone's quality of work, and this creates new sources of tension and stress" [translation] (Landry, R. and Rivard, S., 2001, p.58).
- *Characteristics of the integrator*: The risk tied to the integrator's lack of expertise was relatively low, since the members of the consortium had already worked on several ERP implementations.

## Lessons learned

The implementation met three out of four of its objectives: arriving on budget, finishing in time, and delivering a quality system. The project cost for the first three years was \$22 million short of the \$125 million budgeted. Furthermore, the project team met the deadlines set for commissioning the system—November 2, 1998 and May 3, 1999. The system quality objective was also met, particularly in terms of the scope of the system's functionalities. These three objectives were attained because of actions taken before and during the project to minimize risk exposure.

The team was able to minimize the risk tied to **project size** because Hydro-Québec decided at the outset that the software would not be customized, and it did not waver on this issue.<sup>12</sup> "Anything that could have increased the scope of the project triggered discussions about its impact on project costs, deadlines and benefits." [translation] (Landry, R. and Rivard, S., 2001, p.56). Team leaders supported this policy; they "knew why any temptation to add functional features, linkages or interfaces had to be resisted" [translation].

The problem of a **lack of internal expertise** was attenuated by selecting integrators who could offer added value (Bélanger, J., 2001, p. 69) in terms of their functional expertise in the software package, the implementation process and their ability to advise their client organization on methods. Furthermore, the consortium selected for the project consisted of three well-known integrators. Finally, Hydro-Québec had included knowledge transfer to its internal project team in the consortium's mandate and provided extensive training to its employees.

The **organizational environment** risk factor was mitigated by a series of change management measures, including:

- The selection of a dedicated project team rather than a matrix organizational structure came out of the observation, made from a study of the experiences of companies that have implemented R/3, that this approach would be one of the conditions of success. This project team, assembled from resources from the administrative units involved in the project,<sup>13</sup> was led by a professional project manager (Bélanger, J., 2001, p. 69).
- The selection of members of the steering committee responsible for overseeing the project. The committee consisted of senior IT, human resources, procurement and accounting managers (Landry, R. and Rivard, S., 2001, p. 60).

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<sup>12</sup> Hydro-Québec adopted a "vanilla" implementation.

<sup>13</sup> Human resources, procurement, accounting and IT.

- The involvement of senior management through “written commitments from executive vice presidents on intended results in their respective business units, a commitment that should be reflected in their objectives.” (Landry, R. and Rivard, S., 2001, p. 60).
- Creating an internal audit team to monitor the project. The team had a mandate to “focus on costs and schedules and ensure that the software package was not modified and that the processes complied with best business practices and supported process controls” (Landry, R. and Rivard, S., 2001, p. 60).
- Informing all the team leaders of important deadlines, key aspects of the budget and the roles and responsibilities of all parties during the implementation.

The fourth objective, however, was not met, given that a certain amount of dissatisfaction was noted among users: “The first year of operation (1999) was marked by some rough patches and a certain amount of anxiety. Some even spoke of a ‘virtual ice storm’ that had hit their daily activities” [translation] (Landry, R. and Rivard, S., 2001, p. 62). One of the lessons learned was that “managing change and managing training play critical roles” [translation] (Landry, R. and Rivard, S., 2001, p. 64). Despite the effort invested in these areas, “change management in a project this size should have begun as soon as possible.... In terms of the training, we learned that a winning strategy would have been to focus above all on familiarizing employees with the new processes and not to discuss the technology directly at the beginning. As one manager stated, ‘Rather than beginning by putting a mouse in the hand of a warehouse clerk, it would be better to put him in a room without a computer and spend a full day getting him to understand that working with a computer mouse was going to change his work and, above all, change how the organization went about its business.’” [translation] (Landry, R. and Rivard, S., 2001, p. 64).