Université de Montréal

Critical Success Factors in Information Technology Project Management

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Résumé

Ce mémoire examine les facteurs contribuant au succès (ou à l'échec) des projets, spécifiquement en systèmes d'information. Cette étude soutiendra que les modèles traditionnels et fonctionnels de la gestion sont inadéquats en regard à la réalité changée d'aujourd'hui qui est davantage concentrée sur l'avantage concurrentiel, particulièrement là où la technologie de l'information est concernée. Lorsque certains facteurs clefs sont pris en considération, des changements fondamentaux dans les stratégies de gestion en faveur des philosophies de gestion de projet peuvent ajouter une valeur significative à une organisation. Cette étude identifie empiriquement ces facteurs, qui ont été démontrés pour affecter le succès (échec) de projet. De plus, il examine l'impact relatif de ces facteurs, en particulier dans le contexte des projets de systèmes d'information. Les données ont été rassemblées par l'intermédiaire d'un questionnaire auto-administré à un groupe de membres haut-impliqués des équipes de projet de technologie de l'information. Les résultats ont identifié que l'appui de la direction, le personnel et la mission du projet étaient des facteurs qui ont émergé comme ayant un impact significatif sur le succès de projet de systèmes d'information à de diverses phases du cycle de vie de projet. Les résultats peuvent servir d'indications aux gestionnaires de projets de systèmes d'information, leur permettant de se concentrer sur ces facteurs dans la poursuite du succès.

Mots clés : Cycle de vie de projet, phase de projet, structure de projet, succès de projet, échec de projet, systèmes d'information, facteurs de succès

Abstract

This thesis examines the factors contributing to the success (failure) of projects specifically in Information Technology. This study will argue that the traditional, functional models of management are inadequate in addressing today's changed reality that is more focused on competitive advantage, especially where Information Technology is of concern. When certain key factors are taken into account, fundamental shifts in management strategies in favour of Project Management philosophies can add significant value to an organization. This study empirically identifies those factors that have been demonstrated to critically affect project success (failure). Furthermore, it tests the relative impact of these factors, within the context of Information Technology projects in particular. Data was collected via a self-administered questionnaire polling a sample of highly-involved members of Information Technology project teams. Results identified that Top Management Support, Personnel and Project Mission were factors that emerged as having a significant impact on Information Technology Project Success at various phases of the Project Life Cycle. Results can serve as guidelines to Information Technology Project Management leaders, enabling them to focus on these factors in pursuit of success.

Key words: Project Life Cycle, Project Phase, Project Structure, Project Success, Project Failure, Information Systems

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List of Abbreviations

CEO	Chief Executive Officer
CIO	Chief Information Officer
CSF	Critical Success Factors
HRM	Human Ressource Management
IS	Information Systems
IT	Information Technology
IV	Independent Variables
ORHRI	Ordre des conseillers en resources humaines et en relations industrielles agréés du Québec
P.I.P.	Project Implementation Profile
PM	Project Management
PMI	Project Management Institute
PMIBoK	Project Management Institute's Guide to the Project Management Body of Knowledge
PMP	Project Management Professionals
USD	United States Dollar

Dedicated to my father, Shimon Dolan.
I remember when he used to read to me about a kingdom by the sea...

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I would like to sincerely thank my director, Prof. Belout, for his years of patience, guidance and commitment. They are what finally got me to this point. Merci infiniment.

I would also like to thank Michael, my life partner, my coach and my cheerleader. You inspire and motivate me to apply myself.

Objective

"To err is human, but to really foul things up requires a computer".

- Anonymous

A new economic reality is emerging in which knowledge and processes have replaced the commodity and manufacturing engines of the past. In order to survive in this new reality, corporations place higher priorities on the threefold constructs of knowledge, technology, and innovative management. **Project Management** is a tool gaining significant interest and popularity as a form of new, non-conventional management styles, across a large cross section of fields including that of **Information Technology**. Despite the widespread use of Project Management, many Information Technology projects still result in failure; this study will address this phenomenon.

In an effort to contribute to scientific research in Organizational Behaviour (an important component of Industrial Relations); this thesis endeavours to explain success (failure) in a particular angle of management known as Project Management as it applies to a particular sector of activity, specifically Information Technology.

More particularly, the study borrowed elements from a theoretical model developed by Pinto and Prescott (1988), wherein they identify ten factors considered to be critical in Project Management success. It also used a conceptual model, incorporating these factors, developed by Belout (1998), in an attempt to assess the relative impact of these factors on the success (failure) of a project. Finally, it followed the same methodology that was put forward by Belout and Gauvreau in 2004.[1] While the above-mentioned models focus on Project Management in a generic sense, our study will focus on Project Management (hereafter PM) within the Information Technology (hereafter IT) sector only. To the best of our knowledge, no

[1] Belout and Gauvreau's (2004) model and questionnaire, tested Pinto and Prescott's (1988) critical success factors, having interest in examining the impact of one factor in particular, namely the human resource management factor. This study, in contrast, will differ in that it will examine the relative impact of all the factors, but will significantly differ in that it focuses on IT projects only.

such empirical study, using this conceptual framework and methodology has been previously conducted or reported.

This thesis is inspired by the growing trends emerging in both the adoption of Project Management as a management strategy, as well as the huge investment that many firms make in IT for its technical and managerial benefits in contributing to organizational effectiveness (Finch, 2003; KPMG, 1997; Nah et al., 2001; Powell and Dent-Micallef, 1996; The Standish Group, 1999; Weill, 1992).

Despite IT's *potential* to contribute to organizational effectiveness; particular phenomena have been reported with respect to IT projects, which serve as the impetus and justification for conducting a study that focuses specifically on IT. The first of these phenomena is that *there is a large investment in IT resources in industry* (Weill, 1992). According to Weill, in the service sector:

> "IT as a percent of capital stock increased threefold over an 18-year period from 6.4% in 1970 to 19.8% in 1988. In the manufacturing sector [...] the increase has been even more pronounced, growing from 1.6% in 1970 to 10.6% in 1988" (Weill, 1992; 307-308).

Along the same lines, The Standish Group (1999) reports that in the U.S., more than $275 billion USD is spent annually on approximately 200, 000 application software development projects.

The second important phenomenon is that *a large amount of IT projects result in perceived failure* either by exceeding planned budget and/or time or by not even being completed (Boston Consulting Group, 2001; Ewusi-Mensah, 2003; KPMG, 1997; The Hackett Group, 2003; The Standish Group, 1995). Staggering statistics report 31.1% of projects will be cancelled before being completed and 52.7% of projects will cost 189% of their original estimates (The Standish Group, 1995). According to the Standish Group (1995), the failure to produce reliable baggage handling software at the new Denver Airport cost the city an astounding $1.1 million per day. Similarly, the Hackett Group (2003) reported that 30% of all application

projects lasting more than a year did not meet their business requirements, while Ewusi-Mensah (2003) reports that based on a 1994 study of 82 Fortune 500 companies, 44% of all respondents reported total project abandonment.

Given the high perceived failure rate, the logical question would be *why* are these projects failing? Our logic is that assessing the impact of Pinto and Prescott's (1988) proposed critical success factors in PM within IT projects, we may shed some light on the answer to this question.

Aside from identifying critical success factors, Pinto and Prescott's model also includes *Project Life-cycle* as a construct. They claim, as does much of the popular literature, (Adams and Barndt, 1988; Archibald, 2001; Fish, 2003; King and Cleland, 1983; Patel and Morris, 1999; Pinto and Prescott, 1988; Wideman, 2004) that a general characteristic of projects is that they typically run through certain specific phases (to be discussed in greater detail in the literature review), and that their critical success factors may have differing impacts across project phases. Belout's (1998; 2004) model includes *Project Life-cycle* as a moderating variable as well. Therefore, by using Belout's (1998; 2004) model and thus, including Project Life-cycle as a moderating variable in this study, we may be able to better understand not only *why* IT projects are failing, but also *at what stage*.

Moreover, consistent with Belout's (1998; 2004) proposition, we will also include the construct of *Project Structures* (also to be discussed in greater detail in the literature review section) as another moderating variable. In essence, different Project Structures have been reported to have specific strengths and weaknesses within the project context (Gobeli and Larson, 1987). Therefore, the proposed study will also be able to test *their* moderating effects on IT project outcome.

If, in fact, Pinto and Prescott's (1988) critical variables are the same predictors of project success in IT projects (moderated by Life-cycle and Project Structure) as they are in a cross-section of project types, the results of our study may

provide project managers with clarifications as to what measures of control to exercise during all phases of their projects, and across various organizational structures, which may result in lower IT project failure rates.

As such, our principle research question is:

What is the relative impact of the Project Management critical success/failure factors on IT projects?[2]

The present document will provide a brief overview of what the principal scholars in the field of Project Management and IT are saying, and will then describe our study, our results, and will shed some light on the answer to our research question.

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[2] Note: More specific hypotheses will be described later on after having presented the literature review and the conceptual model.

Chapter 1 Literature Review

1.1 Introduction

In an effort to lay the theoretical groundwork for our study, the literature overview presented hereafter centers around three primary themes: 1) Project Management, 2) Information Technology and 3) Information Technology Projects.

In the section on Project Management, we will attempt to define the notions of both Projects and Project Management, identifying key characteristics of both. Furthermore, we will discuss the benefits of using Project Management as a particular management strategy, how to define successful projects, and the factors associated with project success. Finally, within this section, we will also define the constructs of Project Life Cycle and Project Structure, and how they can moderate project outcome.

The second section of our review will define Information Technology, and discuss how its appropriate use can contribute to organizational effectiveness and ultimately, contribute to an organization's goal of competitive advantage. In addition, we will consider how IT success is measured, and identify certain barriers to IT implementation.

The final section of our literature review will merge the concepts of Project Management and IT, such that we will present IT Project Management. Here, we will try to describe industry phenomena related to IT projects, and more particularly, today's high failure rate in these projects.

1.2 Project Management:

This section will focus on presenting Project Management, an emerging management-style trend, particularly within the context of the proposed study.

1.2.1 Defining a Project

Given the pace of change in today's economy, organizations are re-visiting the *way* in which current products and services are brought about. Whereas, traditionally, work relied upon "...linear, sequential arrays of highly specialized and synchronized effort" (Gilbreath, 1987, p.3), which Gilbreath (1987) calls *operations*, today, a significant amount of work is being carried out under the form of *projects*.

A project is a particular form of management that differs from other forms of management in that it is limited in both time and effort. Despite the fact that various authors may define projects differently (Adams, 1997; Genest and Nguyen, 1990; Morley, 1996) there are still universal characteristics that allow the concept of a project to be contrasted with other forms of management. The primary difference between operations and projects is that operations use existing tools and processes in the most efficient way possible to produce goods and/or services, while projects involve more concerted, temporary effort to create a limited impact (Gilbreath, 1987). A project will end as soon as its desired result is achieved. In operations-style management, the process is established, and a product results. In projects, the desired result is defined and, within this context, the process is designed. Projects have specific goals, clear beginnings and ends, assigned resources (dollars, equipment and people), and organized sequences of activities, tasks and events. The project is complete once these activities and events are completed, and the outcome is either produced or cancelled. (Gilbreath, 1987; Kerzner, 2003; Knutson and Bitz, 1991; Lewis, 1993; Morris, 2002).

According to Gilbreath (1987) the reason that management by projects is becoming more and more popular, and potentially essential, has to do with the notion of *change*. He claims that change (social, economic, technological and political) has caused organizations to revise their business activity and models. Rather than adhering to traditional *operational* organization of work (as in an assembly line), in response to change, work can be organized into *projects*, "...parallel, unsynchronized, and generalized effort not tied to or dependent upon any established tools or techniques" (Gilbreath, 1987; 3). The benefits to organizing work in this method are that it provides organizations with the ability to respond to change more rapidly, and allows them the opportunity to create new initiatives without being restricted to existing processes and tools.

1.2.2 The Characteristics of Projects

Despite an assortment of definitions, most researchers agree (Cleland and Kerzner, 1985; Cleland and King, 1983; Kerzner, 2003; Morris, 2002; Tuman, 1988) that projects possess the following characteristics: "a) a specified, limited budget, b) a specified date for completion, c) a preordained performance goal or set of goals, and d) a series of complex or interrelated activities" (Pinto and Prescott, 1988, p.6). Projects are thus always restricted by time, budgetary, and resource restraints, and always have an objective. Gilbreath (1987) suggests that it is easy to identify a project when the result is a tangible product like a building or an airplane. However, efforts such as the performance of a heart transplant or conducting a political campaign are also efforts, not necessarily involving final products, which also fall within the project rubric. Thus, in all project cases, there is still an objective or goal.

In contrast to projects, Lewis (1993) provides various examples of business endeavours that are *not* considered projects such as: processing insurance claims, manufacturing widgets, or cooking in a restaurant. Simply put, anything that involves continuous, repetitive behaviour does not fall under the umbrella of project activity.

1.2.3 Defining Project Management

As the foregoing suggests, given the proliferation of work being organized into projects, *Project Management* is the discipline of strategically managing all the elements associated with projects. Kerzner (2003, p.4) defines Project Management as:

> "The planning, organizing, directing, and controlling of company resources for a relatively short-term objective that has been established to complete specific goals and objectives. Furthermore, project management utilizes the *systems approach* to management by having functional personnel (the vertical hierarchy) assigned to a specific project (the horizontal hierarchy)".

Knutson and Bitz (1991, p.1) suggest that project management fulfills two purposes:

> "1) It provides the technical and business documentation to communicate the plan, and, subsequently, the status that facilitates comparison of the plan against actual performance, and 2) it supports the development of the managerial skills to facilitate better management of the people and their project(s)".

1.2.4 The Characteristics of Project Management

Given the above definition of Project Management, there are certain global characteristics or activities that take place within the management of all projects. Lewis claims that project management always includes the elements of "planning, scheduling, and controlling of project activities to achieve project objectives" (1993, p.15). According to Kerzner (2003), Project Management involves tasks like project planning and monitoring. These tasks are comprised of the following elements:

- Project planning:
  - Definition of work requirements

- Definition of quantity and quality of work
- Definition of resources needed

- Project Monitoring:
  - Tracking progress
  - Comparing actual outcome to predicted outcome
  - Analyzing impact
  - Making adjustments

Morris suggests that:

> "At a minimum, there is (a) integration of the work of others needed to assure project success – the 'single point of integrative responsibility' [Archibald, 1997] – (b) the application of certain project management practices. It is the extent of application of these practices, and the nature of the integration, that leads to differences in definition" (2002, p.5).

Lewis (1993) further defines four primary objectives that exist in all projects. Essentially, projects must all be realized: 1) at the desired performance level (P), 2) within cost or budget constraints (C), 3) on time (T), and 4) while holding the *scope* of the project constant (S) and using resources efficiently and effectively. There is a definitely a relationship between these objectives, where all four cannot be tied down simultaneously. If three are specified, one must be allowed to vary. Lewis illustrates this with the following equation:

$C = f(P, T, S)$, where *Cost* is a function of *Performance*, *Time* and *Project Scope*.

As an example of this formula applied, Project Cost will increase if any or all of Performance, Time, and Scope increase.

Another characteristic or general rule about project management is the fact that all projects follow a certain *life-cycle* of anywhere from two to six phases (this aspect of Projects will be discussed in greater detail in the section on *Project Life-cycles*).

1.2.5 The Benefits of Project Management

Intrinsically, there must be *value* to Project Management since it has gained so much attention and widespread use. Now that we have defined and discussed the concepts and characteristics of Projects and Project Management, this section will examine why Project Management is gaining in popularity and will look at some of the benefits associated with using Project Management as a tool. Cook and Pritchard (1998) discuss five benefits of Project Management as described below:

1) It is a proven practice.

The history of Project Management dates back 5000 years. It became a modern practice during World War II when organizations had to find new ways to break functional boundaries, and accomplish complex tasks using resources from different areas of skill. Since then, more and more organizations have embraced this as a management style being used in the construction, aerospace, pharmaceutical, technology, and telecommunications industries. Today, there are very few business sectors that do not touch upon Project Management in some form.

Project Management has sparked the creation of professional associations, with the most well known being the Project Management Institute (PMI), founded in 1969. In 1981, the institute created a set of practices enabling professional accreditation with the first Project Management Professionals (PMP) being recognized in 1984. Additionally, other international professional associations exist, including the Association of Project Managers (founded in 1972 in the UK) and the International Project Management Association (founded in 1965, based in Denmark).

These associations allow Project Managers to speak a common language, thus promoting clear communication and improving customer relations.

2) It is a time saver.

With the appropriate authority and control, Project Management *can* be a time saver. If the project manager is involved at the outset, Project Management can save time given that it is used at the beginning of a project. The Project Manager is in a position to set realistic deadlines for the project's completion, when he/she is involved in *planning* the time it will take to carry out the project. Thus, the manager cannot be used only for monitoring project status, because this would remove an important element of control over the project outcome. If the project manager is not involved in developing the project schedule, and it is planned by functional specialists or proposal writers who may not be aware of the intricacies involved in the project's execution, the project schedule may run the risk of being unrealistic.

Project managers can also save time for an organization by *tracking* when and why project activities are behind or ahead of schedule, and learning from these. Functional managers had this responsibility before the proliferation of project management. These managers (functional) may perceive this tracking process as a nuisance interfering with their 'real jobs'.

Given that Project managers shield upper management from the project teams, they also save the time of upper management in having to deal with project resources. The team need not run to upper management to resolve concerns, in the case of problems arising. Rather, the project managers can serve as communication conduits.

3) It is a money saver:

Project management can save money through appropriate *project planning*. Project planning is the least expensive of the various project phases (to be discussed later in greater detail), as it requires little expense in terms of material, with the bulk of the money being spent on human resources. However, it is during this planning period that the project manager can establish a baseline according to which project success/failure can later be measured. Project managers, with their cross-functional skills, are more adept at setting this baseline than traditional functional managers who do not have the same global understanding of the project as a whole.

Project Management has another money-saving effect in that it *deploys resources* more effectively. The allocation of resources to projects is one of the key elements in many project management software packages. Again, with the broad view that project managers have, they can effectively assign resources to tasks ensuring that they are, for lack of a better word, optimally exploited.

Project *tracking* is another money-saving aspect to project management. This process enables the manager to monitor project progress such that he/she can avoid and/or address project problems quickly.

Project *reserves* can also be an effective way to reduce project costs. Rather than including bulky resources as part of the initial project (which may un-necessarily inflate project costs), the manager can use resource reserves on a need only basis.

Finally, ensuring project *termination* or *closeout* can also translate into money savings. The process will not linger beyond its time, potentially causing additional drain on an organization's resources, when the parties involved ensure consensus over a project's termination.

4) It optimizes organizational efficiency.

Project management allows resources to be rallied from a task-oriented perspective rather than a functional perspective. The early 1900s saw a need to structure individuals in a way where they could perform a single mission effectively, whereby human resources developed areas of expertise. As such the functional organization of work was born. Customers were becoming more and more demanding in the mid-1900s requiring both service and integrated solutions, which led to a need for the development of cross-functional teams. These teams required a focal point of responsibility to ensure oversight of these cross-functional projects (the project manager) alleviating this burden from the functional managers, whose specialty was really in managing specialized resources.

Project management also builds *teamwork* and *employee growth* in the sense that the manager brings together resources that **must** work together cohesively. The team building skills fostered during a project can be carried with an employee throughout his/her career. With a clear objective, sense of direction and potential for accomplishment, team members develop skills that enable them to work on other cross-functional endeavours within an organization, or even in others. Furthermore, the project serves each team member, as he/she develops a sense of contribution/participation to the success/failure of the project.

5) It meets customer needs:

The client expectations are outlined right at the beginning of a project process. These can be defined overtly, but they may also be more covert based on the interaction between the client and the project manager. In an initial project with a client, the project manager's interaction with the client sets the scene for subsequent projects, where the client develops certain rapport expectations from the servicing organization based on the experience he/she had with the project manager. The project manager has the responsibility of ensuring that those expectations are met from that moment on. If the customer sees consistency in the way that expectations are met, this will

forge the loyalty bond between the customer and the supplier such that both organizations benefit.

Kerzner (2003) discusses the following benefits of Project Management, similar to the benefits outlined above:

- Identification of functional responsibilities to ensure that all activities are accounted for, regardless of personnel turnover;
- Minimizing the need for continuous reporting;
- Identification of time limits for scheduling;
- Identification of a methodology for trade-off analysis;
- Measurement of accomplishment against plans;
- Early identification of problems so that corrective action may follow;
- Improved estimating capability for future planning;
- Knowing when objectives cannot be met or will be exceeded.

However, in order to achieve these benefits, Lewis (1993) also suggests certain potential obstacles (listed below) that must not be neglected:

- Project complexity
- Customer's special requirements
- Organizational Restructuring
- Project Risks
- Changes in Technology
- Forward planning and pricing.

1.2.6 Defining Project Success

Whereas the above description discusses the benefit of Project Management as a management strategy, certainly the primary goal in using this strategy is to achieve

successful projects. This section will discuss what researchers propose with respect to the determination of whether a project's outcome is successful.

Pinto (1998) suggests that assessing the success or failure of a project is not a simple task. The first reason is that success/failure is a subjective term, which can certainly be in the eye of the beholder. The project outcome can be mislabelled without objective terms to determine whether or not a project is considered successful. Furthermore, at times, the nature of the data used in project assessment may be incomplete such that evaluating projects midstream can be problematic.

Historically, an attempt at an objective determination of project success involved what Pinto (1998) describes as the "triple constraint", used in 'the old days'. The three constraints were: 1) Time 2) Money and 3) Performance. In this context, *time* refers to the project meeting or exceeding its scheduled deadlines, *money* refers to the project being completed with its budget allocation and *performance* refers to the notion that the project result performs as it was intended to perform. Pinto (1998) goes on to say that in today's modern business, this triple constraint model no longer works well, as each of the three measures used are internal. In other words, each element satisfies a different internal interest group. For example, the money constraint concerns the internal accounting group, while the performance constraint might concern the internal engineering group (in the case of an engineering project). The customer element, however, is missing in this model is. Pinto (1998) maintains that the new rules in Project Management need to embody a fourth element, causing a quadruple constraint. The fourth element that Pinto includes is *customer satisfaction*. His logic dictates that today's project manager must not only manage project activities, but must also take on the sales function of managing client relations. After all, there is no benefit if a project is successfully complete according to the triple constraint, and no one buys the project outcome (the product or service created).

Kerzner outlines that today's definition of project success includes completing the project:

> "...within the allocated time period, within the budgeted cost, at the proper performance and specification level, with acceptance by the customer/user, with minimum or mutually agreed upon scope changes, without disturbing the main work flow of the organization, and without changing the corporate culture" (2003, p.6).

Beyond the abovementioned quadruple constraint model described by Pinto (1988), Kerzner (2003) discusses three additional elements: *scope*, *workflow*, and *corporate culture*. He claims that major scope changes in projects can destroy both project morale as well as the entire project itself such that they *must* be kept to a minimum and furthermore, *must* be approved by the client/user. In terms of workflow, Kerzner (2003) suggests that many project managers may view themselves as independent entrepreneurs, and want to separate their work from the context of the parent organization. This, however, is not always possible such that project managers *must* be aware of, and work within, the parent organization's guidelines, policies, procedures, rules and directives. Finally, with respect to corporate culture, Kerzner maintains that a project manager should not expect the human resources working on his/her project to deviate from the organization's cultural norms.

> "If the company has a cultural standard of openness and honesty when dealing with customers, then this cultural value should remain in place for all projects, regardless of who the customer/user is or how strong the project manager's desire for success is" (2003, p.6).

Baker, Murphy and Fisher provide the following definition of project success based on research in 650 projects:

> "...if the project meets the technical performance specifications and/or mission to be performed, and there is a high level of satisfaction concerning the project outcome among key people in the parent organization, key people in the client organization, key people on the project team, and key users or clientele of the project effort, the project is considered an overall success" (1988, p.903).

Given that each element of this definition is biased by perception, the authors found that a more appropriate term for project success would be '*perceived* success of a project'.

Belassi and Tukel (1996) point out that, in general, there are two problems with determining what is project success in an of itself. As maintained by Pinto and Slevin (1989), the first problem is that the *perception* of project success or failure may vary depending on which party is asked; the same project may be considered successful by the client yet unsuccessful by top management. The second problem is that there are variations in the literature with respect to the lists of *factors* contributing to the success/failure of a project, and that these factors may not even *directly* impact the success/failure of the project. "Usually, a combination of many factors, at different stages of project life cycle, result in project success or failure" (Belassi and Tukel, 1996; 142). Given second contention, the *factors* associated with project success will be discussed and presented in the next section.

1.2.7 Success Factors in Project Management

Despite the fact that a project's outcome (success/failure) may be assessed subjectively, there still remain, in the literature on Project Management, certain *factors* that have been demonstrated to be strongly associated with project success/failure. This section will focus on presenting these factors, among which are the ten factors presented by Pinto and Prescott (1988) that serve as independent variables in the present study.

Pinto and Slevin (1988) established ten project management *factors* for project implementation that proved to be significantly correlated with project performance. To assess the impact of these factors, Slevin and Pinto used the Project Implementation Profile (PIP), a tool they developed to assist project managers in applying their model of balancing strategy and tactics (Slevin and Pinto, 1986). The

ten factors that these researchers associated with project success are the following (Pinto[3], 1998):

1) Project Mission, 2) Top Management Support, 3) Project Schedule/Plan, 4) Client Consultation, 5) Personnel, 6) Technical Tasks, 7) Client Acceptance, 8) Monitoring and Feedback, 9) Communication and 10) Troubleshooting. Each of these will be defined briefly:

1) Project Mission:

Project Mission refers to the general goals of the project in terms of its feasibility. Pinto (1998) suggests that both at the project kick-off as well as throughout the project, project managers must ask some fundamental questions: "Are the goals clear to me and the rest of the organization? Are the goals of the project in line with the general goals of the organization?" (Pinto, 1998; 8).

2) Top management support:

Is top management prepared to provide the project manager with the required resources and authority so that he/she can achieve project success? Pinto (1998) claims that the project manager relies heavily on upper-management not only for direction and authority, but also for help in the case that the project runs into difficulty.

3) Project plans and schedules:

This factor refers to the detailed specification of all the tasks required for the project's implementation. Pinto (1998) distinguishes between plans and schedules by

[3] Note: We reference Pinto (1998) from a chapter entitled *The Elements of Project Success* in the Field Guide to Project Management, edited by D. Cleland, Van Nostrand Reinhold, 1988. This chapter was adapted from *Successful Information System Implementation: The Human Side,* by Jeffrey K. Pinto,

indicating that *plans* refer to outlining the *stages* in the implementation process while *scheduling* is the creation of specific time and task-interdependent structures. Scheduling tools can be used to monitor actual performance against the time and budget originally allocated.

4) Client Consultation:

The project manager must ensure that there is communication and active listening for all active parties in the project. Pinto (1998) defines the client as anyone who will be using the result of the project, regardless of whether they are customers outside the company, or departments within the company. When a project manager identifies the project's clients, he/she can better determine whether or not their needs are being met.

5) Personnel:

This factor refers to ensuring that the appropriate human resources are recruited, selected and trained to be part of the project team. Pinto (1998) claims that in many cases the personnel is not adequately selected. The project manager must see to it that human resources have the necessary skills and commitment to perform their functions within the project team.

6) Technical Tasks:

This factor is defined as the required technology and expertise to carry out the technical steps of the project. Organizations must ensure that they have competent human resources as well as the technical means to successfully carry out the project.

PMI Publications (1994) and *Successful Project Managers*, by Jeffrey K. Pinto and O.P. Kharbanda, Van Nostrand Reinhold (1995).

7) Client Acceptance:

This factor relates to the act of 'selling' the project outcome to its intended users. This happens when the project execution phase is complete (this phase will be discussed later on in the *life-cycle* section), at the final stage of the project's implementation. According to Pinto (1998), many project managers falsely believe that just because the other stages of the implementation process were handled well, that the client will automatically accept the result. This, however, is not the case. The project manager must manage the client whereby he/she must be prepared to *sell* the project to clients.

8) Monitoring and Feedback:

This factor refers to the provision of control information at every step of project implementation. Pinto (1998) argues how important tracking is for the project manager to be prepared for problems and deficiencies and seek out corrective measures quickly. However, he also claims that in many organizations "...there is little general agreement on how to track projects, what features to track, and how to report this data" (Pinto, 1998, p.20). Despite this, any sort of feedback mechanism will only positively support project implementation.

9) Communication:

This factor refers to the provision of appropriate channels of communication, and access to data for all key players in the project's implementation. Pinto (1998) points out that this communication is essential within the project team, between the team and the rest of the organization as well as with the clients. Communication issues include: "...the project's capabilities, the goals of the implementation process, changes in policies and procedures, and status reports" (Pinto, 1998, p.20).

10) Troubleshooting:

This final factor refers to the ability to identify and handle problems that may arise during the project that may have been unforeseen in the original plan. Given that it is impossible to initially predict every snag that might arise throughout the course of a project implementation, it is important that the project manager put mechanisms in place that would allow for quick reaction time in the face of trouble (Pinto, 1998).

Aside from the ten critical success factors suggested by Pinto (also Pinto and Prescott, 1988; Pinto and Slevin, 1989) above, there have been other factors identified in the literature that may also contribute to the success or failure of a project. In their 1996 study, Belassi and Tukel summarize the research done on project management critical success factors, and try to elaborate a new framework for determining these critical success factors. A summary of their discussion is as follows:

The authors attempt to a) describe the various factors identified in the literature and then, b) group them by category. Their objective is not to identify all the critical success factors but rather, they contend that this categorization of success factors is a sufficient tool for project evaluation. The authors believe that categorization allows the project evaluator to determine the *combined* effects of these factors.

The additional factors associated with PM success that have been identified by other researchers and are presented in **Table I**[4] (on page 22) taken from Belassi and Tukel's study (1996)[5]:

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[4] From Belassi, W., and Tukel, O.I., *A New Framework for Determining Critical Success/Failure Factors in Projects*, International Journal of Project Management, Vol. 14, No. 3, p.143, 1996.

[5] Note: We will not go into a detailed discussion of the critical success factors discussed by other researchers as the model used in the present study proposal contains only Pinto and Prescott's (1988) critical success factors. However, a more detailed discussion of critical success factors proposed by other researchers may be presented in the literature review section of our final thesis.

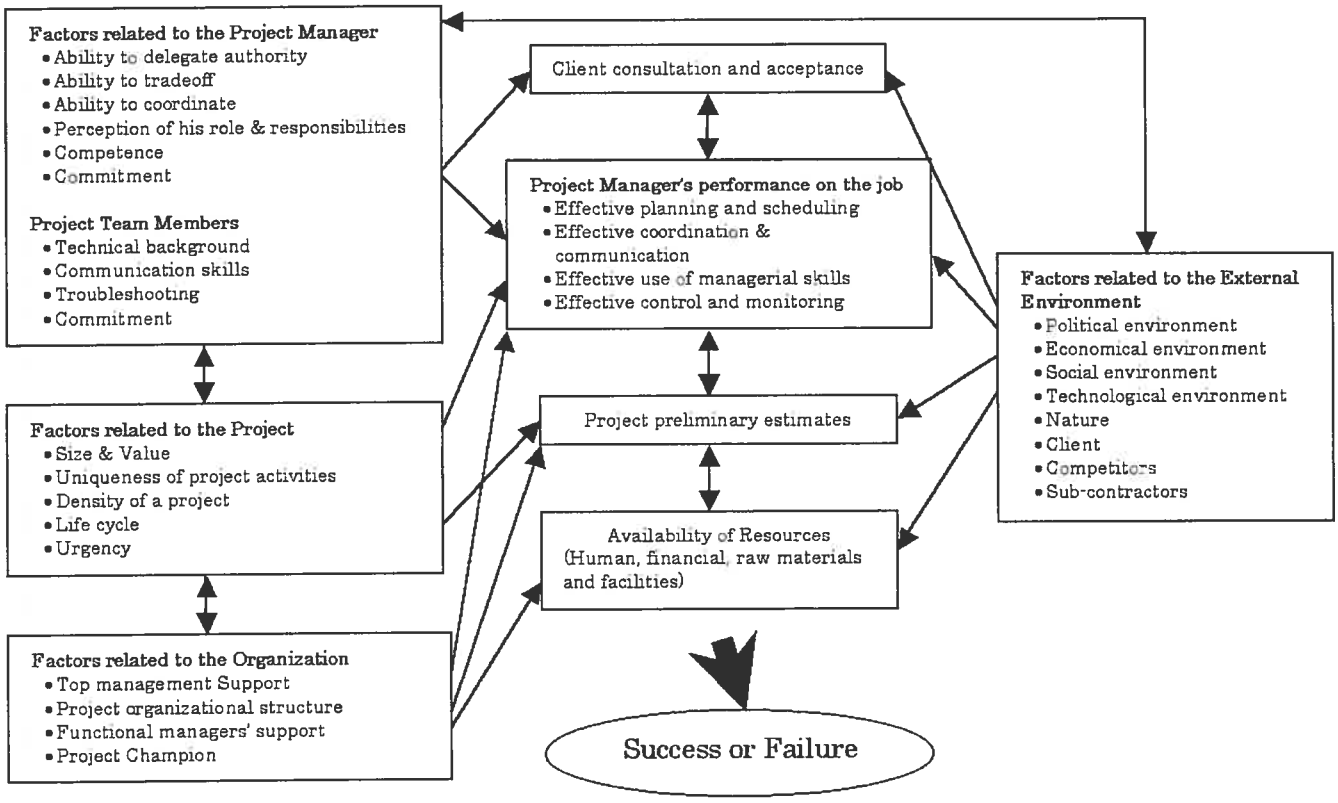
Table I: CSF Developed in the Literature

Seven Lists of Critical Success Factors Developed in the Literature						
Martin (1976)	**Locke (1984)**	**Cleland and King (1983)**	**Sayles and Chandler (1971)**	**Baker, Murphy and Fisher (1983)**	**Pinto and Slevin (1989)**	**Morris and Hough (1987)**
Define goals	Make project commitments known	Project summary	Project manager's competence	Clear goals	Top management support	Project objectives
Select Project organization -al philosophy	Project authority from the top	Operational concept	Scheduling	Goal commitment of project team	Client consultation	Technical uncertainty innovation
General managemen t support	Appoint competent project manager	Top management support	Control systems and responsibilities	On-site project manager	Personnel recruitment	Politics
Organize and delegate authority	Set up communica- tions and procedure	Financial support	Monitoring and feedback	Adequate funding to completion	Technical tasks	Community involvement
Select project team	Set up control mechanisms (schedules, etc.)	Logistic requirements	Continuing involvement in the project	Adequate project team capability	Client acceptance	Schedule duration urgency
Allocate sufficient resources	Progress meetings	Facility support		Accurate initial cost estimates	Monitoring and feedback	Financial contract legal problems
Provide for control and information mechanisms		Market Intelligence (who is the client)		Minimum start-up difficulties	Communication	Implement problems
Require planning and review		Project schedule		Planning and control techniques	Trouble- shooting	
		Executive development and training		Task (vs. social orientation)	Characteristics of the project team leader	
		Manpower and organization		Absence of bureaucracy	Power and politics	
		Acquisition			Environment events	
		Information and communication channels			Urgency	
		Project review				

Belassi and Tukel (1996) created four categories of factors into which they could classify potential critical success factors (CSF). As mentioned above, they did not want to come up with *all* the critical success factors, but rather with a classification system. Using this system they suspected that project managers would be able to better understand and evaluate the *aspects* of a project that are most critical to its success. They created four groups of factors: 1) Factors related to the project, 2) Factors related to the Project Manager and Team Members 3) Factors related to the organization and 4) Factors related to the external environment. They suggest that

any of the factors proposed in the literature can fit into one of these factor groups. The authors also maintain that the various factor groups can influence each other, and that this inter-relationship can help project managers more clearly understand their project's critical success factors. See **Figure 1** [6] on page 23, which is Belassi and Tukel's (1996) proposed model for how the categories of factors can interact with each other. The results of Belassi and Tukel's study (1996) are less relevant, as their goal was really to present the framework for the categorization and inter—relation of the factor groups.

Figure 1: Belassi and Tukel's model (1996)



Having presented and defined the critical success factors that will be used in the proposed study model, the next two sections will focus on other variables that may moderate the effects of the critical success factors on project results; these

[6] From Belassi, W., and Tukel, O.I., *A New Framework for Determining Critical Success/Failure Factors in Projects*, International Journal of Project Management, Vol. 14, No. 3, p. 144, 1996.

variables are *Project Life-Cycles* and *Project Structures*. Each of these variables will be defined and briefly discussed.

1.2.8 Project Life-Cycles

As mentioned in the previous section on *Project Management Characteristics,* all projects go through certain phases, and, at each phase different managerial activities are executed. This project phase concept is known as the *Project Life-Cycle*. King and Cleland (1988) have devised a theoretical definition of life cycles for open systems that include the following phases: Conceptual, Definition, Production, Operational, and Divestment. Lewis (1993) suggests the following phases: Concept, Definition, Design, Development or Construction, Application, and Post-Completion. Pinto and Mantel (1990) proposed two phases that include: the Strategic phase, relating to project development and the Tactical phase, relating to the execution of the project and its transfer to the users. For the purposes of this study, we will use one of the most accepted project life cycle frameworks that has been suggested by Adams and Barndt (1988) and King and Cleland (1988), which is used in both Pinto and Prescott's studies of project critical success factors (1988) as well as Belout and Gauvreau's (2004). These are the following four phases:

- Phase 1 – Conceptualization
- Phase 2 – Planning
- Phase 3 – Execution, and
- Phase 4 – Termination.

This section will briefly outline the four aforementioned project phases. **Figure 2**[7] on page 26 displays the four phases, as well as the *effort* required at each of the four phases. A brief description of each phase in the project life-cycle follows:

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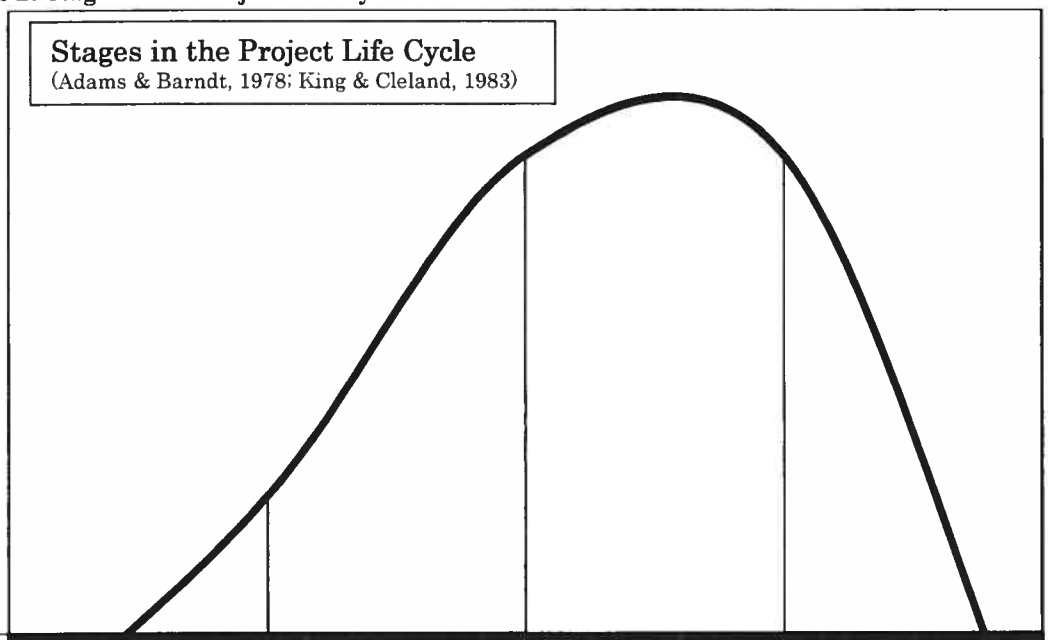
[7] From Pinto, J.K., and Prescott, J.E., *Variations in Critical Success Factors Over the Stages in the Project Life Cycle*, Journal of Management, Vol. 14, No. 1, p. 8, 1988.

Figure 2: Stages in the Project Life Cycle



	Phase I Conceptualization	**Phase II** Planning	**Phase III** Execution	**Phase IV** Termination
Hypothesized Dominant Critical Success Factors	Project Mission	Project Mission	Schedule/Plans	Client Acceptance
	Client Consultation	Top Management Support	Personnel	Client Consultation
		Client Consultation	Technical Tasks	
		Client Acceptance	Troubleshooting	
			Client Consultation	
			Monitoring and Feedback	
			Communication	

Phase 1 - Conceptualization:

This is the first phase in Project Management where the *need* for the project has been identified. Preliminary project goals are outlined in this phase along with the exploration of available resources for the project's execution. Pinto and Slevin

suggest that during this phase, the following questions are asked and answered: "What is the problem? Will the development of a project solve that problem? What are the specific goals of the project? Do we have the resources to support the project?" (1988; 69).

Phase 2 - Planning:

Once the project has been approved and the green light has been given to proceed, the project enters the *planning* phase. This phase deals with two processes: 1) a more formalized outline of how the project will be carried out is established and, 2) the resources and tasks required for the project's completion are determined and allocated. Resources include human resources, materials, budget, and time (Pinto and Slevin, 1988).

Phase 3 - Execution:

During this phase the actual 'work' of the project is carried out. Materials are procured and transformed into the final project result. In this phase the project manager will constantly track the progress of the project to ensure that resources are being used efficiently, and that the project performs as intended (Pinto and Slevin, 1988).

Phase 4 - Termination:

In this final stage, the project result is transferred to the client/users and the project resources are disbanded, released and personnel is returned to the parent organization (Pinto and Slevin, 1988).

As per our discussion, there are different managerial dynamics, levels, and styles required at every stage of the project life cycle. Pinto and Prescott (1988) have already identified that a project's critical success factors (discussed previously), may

have more significant impacts at different project phases. "It was argued that different sets of these factors should be found to be more or less critical to project success depending on upon the current phase in the project life-cycle. The focus of our research was to test this idea" (Pinto and Slevin, 1988; 69). Similar to Belout and Gauvreau (2004), the proposed study will be based on the same critical success factors across the four project phases described above.

Pinto and Slevin (1988) also outline that there is a specific curve in the *effort* required at the various project phases, measured in dollars of man-hours. One can see that the level of effort increases towards the *execution* phase, with the least effort required in the *conceptualization* phase, the most in the *execution* phase, and then effort begins to decrease again in the *termination* phase.

Furthermore, Morris (1988) describes three levels of management decisions that will be used at different phases of the project. Assessing the feasibility of a project implicates management at the *institutional level* (top management) because the decisions at this level will impact the health of the organization and future investment possibilities. The planning or design phase requires management at the *strategic level*, while the production or execution phase requires the *tactical* management level.

Given the variations in activity across project phases, the concept of *Project Life-Cycle*, will be incorporated in this proposed study as a moderating variable. *Project Structure* is another concept/construct that can also moderate the effects of the critical success factors on project outcome, as suggested by Belout (1998). This variable will be discussed in the following section.

1.2.9 Project Structures

Belout (1998) proposes a model for assessing the impact of Pinto and Prescott's (1988) critical success factors on project success. This model is more complete than

that of Pinto and Prescott (1988) as it also includes the construct of *Project Structures* as moderating the impact of the critical success factors. In justifying the inclusion of this construct, he refers to a 1987 study by Gobeli and Larson where they point out that each organizational structure within the context of a project has its strengths and weaknesses. In fact, the Gobeli and Larson, project structure may affect project success (Belout, 1998) by different means. Gobeli and Larson (1987) examined the effectiveness of five different structures, namely: *Functional*, *Functional matrix*, *Balanced matrix*, *Project matrix* and *Project team*. They found that that *project team* and *project matrix* were the most effective structures for the project context. In Belout and Gauvreau's 2004 study, they point to research suggesting that project structure affects the project manager's role, activity coordination, and conflicts, all of which may affect the project outcome. Whereas the project manager's role, activity coordination, and conflicts may directly affect the project outcome, the structural context may amplify or reduce this effect (Slevin et al., 2004; Morris and Pinto, 2004). In keeping with their logic, the moderating effect of the structures that will be examined in the present study will include: *Functional*, *Projectized*, and *Matrix*.

This completes the Literature review related to Project Management, the next section will focus on elements related to the domain of Information Technology.

1.2 Information Technology

This section will focus on defining and discussing the importance and relevance of Information Technology to organizations within the context of the present study.

1.2.1 Defining Information Technology

The term, **Information Technology (IT)**, refers to "...any artefact whose underlying technological base is comprised of computer or communications hardware and software" (Cooper and Zmud, 1990, p.123). Similarly, Orlikowski and Gash (1992, p.2) define IT as "...any form of computer-based information system, including mainframe as well as microcomputer applications". When referring to IT, Powell and Dent Micallef (1996), include computer software, hardware, and linkages. Peter Weill refers to IT as including all "...hardware, software, communications, telephone and facsimile as well as all personnel dedicated to IT, whether centralized or decentralized" (1992, p.308). Therefore, Information Technology can include any sort of foundation for a computer-related system that supports the function, work process, and/or flow of information in an organization.

In much of the literature, **Information Systems (IS)** are not distinguished from IT in terms of being completely separate entities. In fact, frequently, the terms IT and IS are used quasi-interchangeably, referring to the application of technology within the context of business. For all intents and purposes of the present document, IS shall be distinguished from IT only insofar as it being a subset of IT. In other words, IS is considered the subset of IT concerning the computerized flow of information in an organization (software systems), while IT, its parent, includes the hardware and network communications components as well.

There has definitely been a growing evolution in the use of IT within the context of the business organization, especially with the introduction of the PC or microcomputer in the late 1980s, and early 1990s. Microcomputers have the

advantage of being relatively inexpensive, can be installed quickly, can be maintained by the user, and can be used for a plethora of office tools such as spreadsheets, word processors, and e-mail.

> "The increasing speed and capacity of hardware technologies provide a platform for broader application of software in the areas of database management, distributed data processing, expert systems and electronic communication" (Niederman et al., 1991, p.475).

New technologies may offer new promise in terms of enhancing the richness of communication, and increasing automation. The challenge of an IT department is to satisfy the intersection of IT and the needs of the organization; they must keep up to date on emerging trends in technology, assess the impacts of these on the organization, and still maintain and support the day to day operations (Niederman et al., 1991).

In the context of this widespread use of IT within the organizational context, the following section will present some of its impacts on organizations.

1.2.2 The Impact of Information Technology on Organizations

The impact of information systems on organizations refers to the changes that occur in organizations when computing is introduced (Robey, 1987). These impacts can vary from organization to organization as a function of *why* the system was developed and *the way* in which a system was developed (Robey, 1987). At times, IT can affect the centralization of authority (centralization versus decentralization), the routine nature of jobs (routine versus not routine), as well as have no impact at all. Therefore, it is important to understand the *why* and *way* of the system development to determine whether it had the *intended* impact. Buchanan and Boddy (1983) identify three factors explaining the divergence of IS impacts: "...the capabilities and limitations of the technology chosen for the task, the objectives of management, and the physical and organization structures that already existed" (Robey, 1987, p.75).

To illustrate, as described by Robey, (1987), Buchanan and Boddy (1983) studied the impacts of computerization on two jobs in a bakery: A dough man, and an oven man. Despite the fact that automation was introduced it affected each position very differently. While previously, the dough man was responsible for selecting all of the ingredients to be mixed, the computer system selected the ingredients according to a predetermined recipe, such that all the dough man had to do was wait for the mixing to be complete, and add some flavouring. The dough man job, which was once skilled labour, became one that was mundane, where responsibilities became equipment monitoring. On the other hand, before the IT implementation, the oven man, had to manually adjust the oven temperature, as the weight and thickness of the product frequently deviated from the standard. Computerization allowed the oven man to make quicker oven temperature adjustments based on more accurate information. Thus, in this case, there was an information system introduced in the same organization, however its effects on the two workers were completely different. Management's objectives, in this case, were to cut costs and increase product quality by better controlling and improving information. Again, this is an illustration of the fact that it is difficult to make a generalized statement about the impacts of IS on organizations. Rather, according to Robey, these impacts are "...best explained by referring back to the objectives of the information system and the history of the implementation" (1987, p.76).

A significant amount of research links IT to the general performance of a firm[9]. In terms of strategic management, the question at hand would be: What is the role of IT in the financial performance of an organization? A 1996 study of the retail industry by Powell and Dent-Micallef shows that, contrary to previous research (Buday, 1986; Henderson and Venkatraman, 1993; Holland et al., 1992; Kettinger et al., 1994; Sabherwal and King, 1991; Wiseman, 1985) based on case studies, anecdotes, and conceptual frameworks, IT imitation by competitors does *not*

[9] This section relies heavily on T.Powell and A. Dent-Micallef's *Information Technology as a Competitive Advantage: The Role of Human, Business, and Technology Resources,* Strategic Management Journal, Vol. 18:5, 1997, pp. 375-405.

contribute to performance advantage. Rather, "IT creates advantage by leveraging or exploiting pre-existing, complementary human and business resources" (Powell and Dent-Micallef, 1996, p.375). Previous research only concentrated on case studies involving large IT successes. Therefore, pre-1990 IT literature "...focused on the strategic importance of IT adoption and innovation, and reflected a general optimism concerning IT's potential for creating competitive advantage" (Powell and Dent-Micallef, 1996, pp.376-377). Despite this, there was other research by Warner (1987) and Clemons (1986) that focused on the high risks and costs associated with IT as well as the lack of real knowledge about the impact of IT on firm success (aside from several extraordinary cases). Furthermore, other studies have shown that there has been little positive, or no correlation between IT implementation and performance (Floyd and Wooldridge, 1990; Mahmood and Soon, 1991; Neo, 1988; Zahra and Covin, 1993). In 1994, Kettinger et al. even found that, in a study of thirty (30) well known IT cases, 21 out of thirty showed competitive *decline* in the five years following IT implementation.

Mo Adam and Mann (2000) found that there remains a divide among researchers examining the relationship between IT investment and productivity. Part of the reason for this divide may be attributable to the fact that there are various approaches that exist to measure IT payoff.

Two theories have been used to explain the relationship between IT and firm performance: *Resource-based theory* (Barney, 1991; Rumelt, 1987; Teece, 1987) and, the more popular, *Strategic Necessity Hypothesis* (Clemons, 1988; Clemons and Row, 1991; Floyd and Wooldridge, 1990; Kettinger at al., 1994). *Resource-based theory* suggests that a company will seek to imitate, substitute, or acquire the resources of other high-performing companies. Companies can. likewise, sustain competitive advantage by *isolating* (or protecting) their resources in the following ways: a) resources require significant amounts of time to accumulate, b) they are closely linked to other resources within the organization, c) they were acquired under non-replicable conditions, or d) that there can be no clear connection found between

the resources and a firm's performance. Clemons and Row (1991) argue that competitive imitation eventually erodes any sort of advantage that IT may have had, and that furthermore, IT is unlikely to improve overall industry returns.

The *Strategic Necessity Hypothesis* differs in that it claims that value is added to an organization by the implementation of IT through increased efficiency in coordination, and that those companies that **do not** adopt them will have competitive *disadvantages* as their cost structures will be higher. However, IT will not **cause** advantages, in particular, since it is so readily available to competitors, buyers, suppliers, etc. In other words, IT decisions relate more to threats than opportunities, "...i.e. as investments to avoid competitive decline, but with little likelihood of producing sustainable advantages" (Powell and Dent-Micallef, 1996, p.378). Within this vein, if IT is to be linked to competitive advantage, organizations need to adopt one of three IT positions: 1) reinvent advantages through IT innovation, 2) be the *first* to implement a certain IT to get 'first mover' advantages or 3) embed IT within the context of other organizational resources so that resources can work in complementarity (Powell and Dent-Micallef, 1996). This is how both Resource-based theory and Strategic Necessity Hypothesis are merged to explain how IT can, in fact, *increase* competitive advantage. Some authors have also suggested (Clemons and Row, 1991; Henderson and Venkatraman, 1993) that in order to leverage IT so that it *can* contribute to competitive advantage, firms must leverage organization-specific intangible resources like culture, leadership, and business process.

According to various authors, the key to effectively using IT is to combine it with other organizational resources including human and business resources (Benjamin and Levinson, 1993; Keen 1993; Walton, 1989). Similarly, Brynjolfsson and Hitt (1998) found that those organizations that realized the most benefit from IT were those that implemented it in conjunction with other investments like reengineering, restructuring and redesign. This all points to the same conclusion: "...IT advantage depends heavily on 'fitting the pieces together', i.e. on exploiting relationships among complementary organizational resources" (Powell and Dent-

Micallef, 1996, p.379). Powell and Dent-Micallef (1996) also discuss six potential complementary *human resources* to IT, as well as six potential *business resources* to IT.

The human resources are the following: *open organization, open communications, organizational consensus, CEO commitment, organizational flexibility,* and *IT strategy integration* (each will be briefly described), where the most frequently associated with IT performance are *open organization* and *open communications*.

With reference to *open organization* and *open communications*, the benefits of an IT are more apparent a) when there are no structural constrictions affecting the dissemination of information through an IT, b) when employees have access to information that that was typically controlled by upper management, and c) when executives become more like counsellors than authority figures (Zuboff, 1988).

Organizational consensus refers to the cooperation that exists within the organization and lack of conflict therein. Innovation can more often flourish in such environments (Clemons and Row, 1993; Dewoot et al., 1978; Kanter, 1984; Rockart and Short, 1989). On the other hand, IT may also *enhance* consensus within an organization by facilitating communication (Rockart and Short, 1989).

CEO commitment can boost the success of IT by a) ensuring that resources are available, b) by ensuring continued investment, c) by prioritizing the need for an IS, and d) by ensuring that the system is aligned with business strategy (Henderson and Venkatraman, 1993; Kettinger et al. 1994; Neo, 1988). However, quite frequently, CEOs **do not** provide this support, but rather support a status quo position such that IT deployment can suffer (Benjamin et al., 1984; Hambrick et al., 1993; Kanter, 1984;).

Because IT may require changes in structure (Barley, 1990), communication (Huber, 1990), and power relationships (Pettigrew, 1973), organizations must also be *adaptable.* Thus, the resource of *organizational flexibility* comes into play. Orlikowsi and Gash (1992) maintain that managers, technologists, and users alike are required to adapt behaviour during the IT implementation.

The final human resource discussed is *strategy integration,* which refers to the need for an organization to integrate IT within its overall strategic planning objectives (Clemons and Row, 1991; Porter and Millar, 1985; Rackoff et al., 1985; Holland et al., 1992).

In terms of *business resources,* Powell and Dent-Micallef (1996) also discuss six resources complementary to IT, namely: *supplier relationships, IT training, business process design, team orientation, benchmarking,* and *IT planning.*

The *supplier relationships* resource refers to the notion that leveraging IT for inter-organizational transactions requires open and trusting relationships with suppliers. The lack of these sorts of relationships will only create suspicion, and will potentially destroy already fragile relationships (Holland et al., 1992).

IT Training can be used as complementary resource with IT if it merges firm specific IT with firm specific training (Barney, 1991). Otherwise, more generic training is too easily accessible to have any sustainable value.

Business process design (or re-design or re-engineering) refers to the concept of re-evaluating and improving business process. Slapping a computer system on a process that is weak will not yield any benefit. In fact, Powell and Dent-Micallef (1996) cite Hammer and Champy (1993) who claim that misusing technology can even *block* business re-engineering "...by reinforcing old ways of thinking and old behaviour patterns" (p. 382).

IT can certainly favour a team-type of structure (*team orientation)* as e-mail, voice mail and the like can improve the ability of co-workers' coordination across borders and time zones (Rockart and Short, 1989).

Powell and Dent-Micallef (1996) also include *benchmarking* as a complementary *business resource* (given that Bogan and English (1994) say that it may be a good way to assess the cost and functionality of IT). However, they maintain that it is suspect as it would not support competitive, firm-specific, IT implementation, but rather imitation and/or replication of competitor's resources.

Finally, the last business resource discussed by Powell and Dent-Micallef (1996), is *IT planning*. Rather than IT happening haphazardly, the authors suggest that many studies promote planned as opposed to unplanned development. However, they also state that some of the greatest IT successes (notably SABRE, the reservations system developed by American Airlines) did, in fact, happen by accident. In the case of SABRE, it was motivated purely by a shortage in personnel. Thus, the authors include *planning* as a complementary business resource for cases of very firm-specific IT planning.

In their study, Powell and Dent-Micallef (1996) conclude that the competitive advantage in IT results from the **convergence** of the technical, human, and business resources, rather than simply on technology alone. Clearly, based on the above discussion, IT may affect competitive advantage, but, in order for it to do so, the organization must firmly merge it with its other resources.

1.2.3 Obstacles to Information Technology Implementation

Certainly, the purpose behind implementing an Information System is to positively affect the survival of the organization. Huber (1984) suggests that a key element of post-industrial organizations is that:

> "...in general, organizations have survival as a goal and, in general, organizations whose structures, processes and technologies are well suited to their environment have a greater likelihood of survival than do those whose structures and processes are poorly suited to their environment" (p.989)

which is quite a similar notion to that proposed by Powell and Dent-Micallef (1996) outlined in the preceding section. Therefore, a goal of IT implementation is, at least in part, contributing to the effective management of an organization. Unfortunately, a frequent problem related to the implementation of IS, is that systems can be *technical* successes, while still being *organizational* failures (Keen, 1981).

As discussed in the section on impacts, implementing IT brings some sort of change to an organization. However, at times, the organization may not be as prepared for the change as it should, due to what Keen (1981) refers to as *social inertia*. *Social inertia* refers to the notion that "...no matter how hard you try, nothing seems to happen". He describes several causes that explain this sort of inertia, that acts as a barrier to IT implementation: 1) information is just a small component of organizational decision-making, 2) human information-processing is experimental and relies on simplification, 3) organizations are complex such that change is more of an evolutionary process; large steps may be avoided and/or resisted and 4) data is not only intellectual property, but rather, may be political affecting the interests of particular groups.

Thus, this social inertia must be overcome in order for a new IS to be introduced. In other words, there are not only *technical* obstacles to successful implementation, but political ones as well. According to Keen (1981), strategies to overcome the inertia include, policy planning including line managers, formal contracts to ensure commitment, and 'hybrid' skills in system staff so that organizational/political issues are not dismissed. Consequently, there are certainly management issues to consider with respect to IT implementation.

In addition, there are also problems at the technical level of implementation. It is important to note that virtually every element of modern technology from televisions to microwaves to airplanes to corporate payroll systems involve some sort of IS component. Given the increasing demand for software, there is also an increasing demand for software engineers (Bennatan, 1995). These professionals are graduating from colleges at a rate much slower than that at which their skills are required in the marketplace. Therefore, software development [itself] must be "...more productive, more reliable, and generally more successful" (Bennatan, 1995; 2).

While some of the goals of IT implementation may be ensuring that an IT is both properly developed from a technical standpoint and supports a firm's competitive edge, as a general rule, how can organizations measure and/or determine whether IT is successful? A brief review of the literature discussing the notion of IT success follows.

1.2.4 Defining Information Technology Success

In the literature, there appears to be some inconsistency with respect to what is considered a successful information system. Is it one that is technically sound? One that contributes to the organization's competitiveness? One that is accepted by its user community? Based on previous research (Mason, 1978; Shannon and Weaver, 1949) in their 1992 literature review, Delone and McLean identify six variables that they consider to be elements of the dependent variable that is IS success. These variables are categorized as follows and will each be described briefly: *System Quality, Information Quality, Use, User Satisfaction, Individual Impact* and *Organizational Impact*. Delone and McLean cite a significant amount of previous research on IS success, and attempt to fit this research into one of the six categories identified. The research ranges from field research, to lab work, to case studies.

System Quality:

This refers to assessments of the *engineering*-type of attributes of the system in terms of the actual processing system. Measures of system quality within the various studies included flexibility of the system, response time of the system, ease of use, and reliability.

Information Quality:

This category refers to measures of the *output* of the system, in other words, the actual data quality that emerges. The user determined most of these measures of quality, such that they were quite subjective in nature. Within this category, measures used included accuracy, reliability, completeness, and timeliness.

Use:

Information *use* refers to *how* the user *consumes* the Information System output. There is not necessarily uniformity of the measures within this category, as some studies looked at reported use, while others looked at actual use. Regardless of such, Delone and McLean (1992) suggest that *use* is a fairly accessible measure of IS success. Among the measured variables across the different studies were: frequency of use, motivation to use, use to support production, and use to support decision-making.

User Satisfaction:

This refers to the response that the system elicits from its users. Delone and McLean suggest that this is a more relevant measure of success than the preceding measures when the use of the IS is *required.* Furthermore, they point to two studies (; DeSanctis and Gallupe, 1987; Jarvenpaa et al., 1985) that suggest that this measure is appropriate for experimental IS research as well as researching the effectiveness of

group support systems. Additionally, the authors refer to studies (Igersheim, 1976; Lucas, 1978) that found that there is an association between user satisfaction and attitudes towards computer systems in general. They suggest that satisfaction may be biased by computer attitudes. However, given that these studies were done in the 1970s, when computer use was less widespread, it seems questionable whether this would still be the case today, in 2001 when computer use is so commonplace. Measures used in some studies were 'general satisfaction', while others measured more specific, multi-attribute satisfaction.

Individual Impact:

The authors have trouble defining this measure of success:

> "It is closely related to performance, and so 'improving my – or my department's performance' is certainly evidence that the information system has had had a positive impact. However 'impact' could also be an indication that an information system has given the user a better understanding of the decision context, has improved his or her decision-making productivity, has produced a change in user activity, or has changed the decision maker's perception of the importance or usefulness of the information system" (Delone and McLean, 1992, p.69).

Criteria used to measure impact, ranged from quality of decision analysis, to time taken to complete a task, to improved personal productivity, to ability to forecast firm performance. Using this measure, it seems that the researchers were attempting to do a 'before' and 'after' comparison of the change that took place with the implementation of the IS.

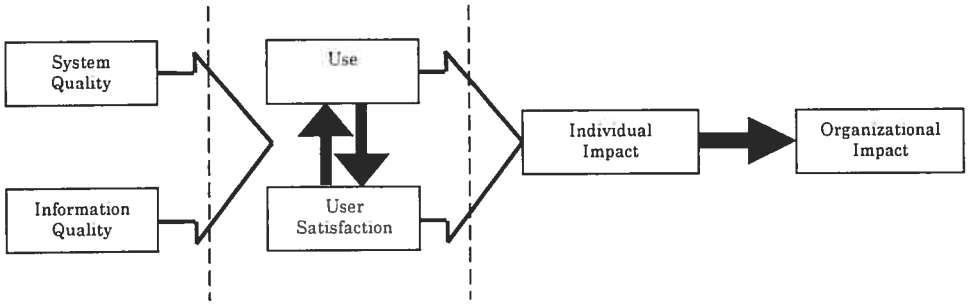
Organizational Impact:

This is the final category measure that Delone and McLean (1992) examined. This measure would be most related to the previously presented section describing the link between IT and firm performance. Despite the fact that the authors point out that

many IS practitioners feel that IS effectiveness is one of the most important issues in IS, researchers tend not to use this measure as it is difficult to separate the effects of the IS from other factors which may affect organizational performance. Some of the measures examined in field studies looking at firm performance were profit performance, production scheduling costs, innovations, and return on investment.

The authors suggest that despite the fact that researchers can choose from a plethora of variables to determine IS success, there should probably be a reduction in the amount of these variables so that studies in order to build a more cumulative body of empirical knowledge. Furthermore, much of the research measured success in only one or two categories, while Delone and McLean maintain that IS success is a *multidimensional* construct and should be measured as such, including measures from several of the categories. These categories are also interdependent, such that the authors propose an IS success model (seen in **Figure 3**[10] on page 42), whereby *System Quality* and *Information Quality* will affect *Use* and *User Satisfaction* (which also affect each other). These (*Use* and *User Satisfaction)* affect *Individual Impact*, which, in turn, affects *Organizational Impact*. Using this model, researchers can systematically select and combine measures from each construct in an effort to create a comprehensive measurement tool.

Figure 3: Delone and McLean's IS Success Model (1992)



[10] From DeLone, W.H., and McLean, E.R., *Information Systems Success: The Quest for the Dependent Variable*, Information Systems Research, Vol. 3, No. 1, p.87, 1992.

Now that IT has been examined and discussed as a field of interest, the next section will attempt to merge the concepts of IT and Project Management by examining phenomena related to IT projects.

1.3 Information Technology Projects: the High Failure Rate

Practically *any* IT initiative can qualify as a project, including installations, upgrades, migrations, technology planning, process improvements, support, training, etc.

IT projects call for a diverse range of skills, resources and approaches. At times, IT projects may focus on **technology**, as with systems rollouts, migrations and upgrades, or software development projects. At other times, IT projects may focus on **business** - feasibility studies, technology evaluation initiatives, standards selection, or workflow analysis and process re-engineering. No matter what the circumstances or focus, all IT projects must be built upon a foundation of solid technology, sound business decisions, and effective, flexible project management practices. Despite all the research and guidelines for IT project implementation, statistically speaking, there is still a significantly high rate of project failure witnessed in industry.

According to Klein and Jiang's 2000 study, a 1998 survey found only a 24% success rate of enterprise management solutions (Gallagher, 1998). The Standish Group reported (1995) 31% of new IS projects were cancelled before completion for a cost to industry of over $81 billion. An additional $59 billion was lost due to budget overruns of those projects reaching completion (PC week, 1995). The Standish Group also reported (1995) that IT projects cost 189% of their original investments. Overall, studies continue to indicate that that about "...85% of all projects end in failure" (Ambler, 1999, p.195).

Although in 2001 The Standish Group reported a decline in the rate of IT failure, with project success rates increasing (cost overruns were decreased from 189% in 1994 to 45% in 2000), their results although encouraging, were far from

good. They found that that 23% of projects failed (the project was cancelled or never implemented), 49% were challenged (the project was completed but either over-budget, over the time restraints, or had less features than originally planned for) and only 28% succeeded (completed on time, on budget, with all the originally specified features and functions).

Why? Given that companies continue to invest heavily in information technology (Thorp, 1998), there must be some sort of benefit, or at least *perceived* benefit to warrant this sort of investment. The questions to ask are:

1) Why are IS projects failing?

2) Are they really failing, or is their success inaccurately measured? Is it a question of metrics?

In Klein and Jiang's text, they quote a 1999 study by Linberg indicating that projects deemed as being 'failures' by organizations, were not necessarily considered to have failed by IS professionals. In fact "...one project that ran over budget by 417% and over the approved schedule by 193% was deemed the most successful project of all by IS professionals" (Klein and Jiang, 2000, p.195). In that case project success was defined as increased knowledge and better team working relationships. Therefore, what measures are used to evaluate the success or failure rate of IS projects?

3) Is there a particular project phase where IS projects typically go sour?

Furthermore, there is the question of alignment of other resources with the implementation of IT (discussed in greater detail in the section on the link between IT and firm performance). IT projects often fail because of an underestimation on the part of management of the organizational shifts required to effectively implement an IT. Management may tend to resist changes towards a more open organization or

culture, as they may perceive this as a threat to the organization's survival (Hannan and Freeman, 1994; Singh et al., 1986; Zuboff, 1988).

According to Verner et al. (1999), the first major work dealing with the difficulties of managing large software development projects was published by Brooks (1975) and entitled: *The Mythical Man-Month.* In this text, Brook notes that Project Management problems in the software domain stem from the following:

> "1. Our techniques of estimating are poorly developed and reflect an un-stated assumption that all will go well. 2. Our estimating techniques confuse effort with progress hiding the assumption that men and months are interchangeable. 3. We are uncertain of our estimates and software managers do not stubbornly support them. We need to develop and publicize productivity figures and stiffen our backbones to defend our estimates. 4. Schedule progress is poorly monitored and techniques used in other disciplines are considered radical here. [and] 5. When slippage is recognized the response is to add manpower. This makes the problem worse because adding manpower to a late software project makes it later" (Verner et al., 1999; 1021-1022).

In a survey conducted by Verner et al., and published in 1999, they endeavoured to verify what software practitioners perceive to be the factors that affect the success/failure of a software project. Results identified nine bipolar descriptor pairs along which the success or failure of a software project can be forecasted. **Figure 4**[11] on page 46 illustrates the factors that emerged:

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[11] From Verner, J.M., Overmyer, S.P., and McCain, K.W., *In the 25 Years Since the Mythical Man-Month What Have We Learned About Project Management?*, Information and Software Technology, Vol. 41, p. 1025, 1999.

Figure 4: Verner et. al's Project Success and Failure Factors (1999)

Project Success and Failure Factors		
Project Success		**Project Failure**
High-Level Management Support	.....	No High-Level Management Support
Involved Stakeholders	.....	Uninvolved Stakeholders
Negotiated, well-defined requirements	.....	Non-negotiated, vague requirements
Experienced Project Manager	.....	Inexperienced Project Manager
Accurate developer-driven estimates	.....	Inaccurate, management-driven estimates
Appropriate lifecycle models	.....	Inappropriate lifecycle models
Managed Risk	.....	Unmanaged Risk
High Intra-Team Communication	.....	No Intra-Team Communication
Low Staff Turnover	.....	High Staff Turnover

Essentially, this study found that most projects that heeded Brooks' advice (from his 1975 publication) were more likely to be successful. However, in the last 25 years, given the evolution in computing, additional problems related to software projects emerged: "...related to end-users, their level of technical sophistication, and the high level of complexity of the development environment" (Verner et al., 1999, p.1025), such that the challenge of developing successful IS is still rampant.

Another fact proposed by various scholars is the concept that software system implementation is frequently done in an amateur, non-methodical way. If software projects are executed without using orderly development, they may not necessarily fail but probably have a higher likelihood of doing so. Bennatan (1995) gives the example of person A waiting at a stoplight for the light to turn green before crossing the street. Person B checks that there is no traffic in sight and jets across the street quickly laughing at person A still waiting at the corner. Despite the fact that person B made it across the street safely this time, he is more likely to be hit by a bus. This logic applies to software projects as well. An orderly development process reduces the risk of project failure but has the price of requiring greater resources in planning (Bennatan, 1995).

The Hackett Group (2003) noticed a difference in the failure rate between average companies and world-class companies where in average companies 30% of IT projects failed while this statistic was only 18% in world-class companies. They discovered several variables to explain this discrepancy. One being that world-class companies can react better to change since they have better access to decision makers, have better organizational structure, have the right skill sets in place and have integrated technology and information architecture. They also found that world-class companies had significantly more automation, are more likely to have an IT executive (i.e. a CIO), were more likely to have better management practices since they had a formal Project Management Office and had more meaningful IT performance measures.

A question that comes to mind is whether software project managers are, in fact practicing the appropriate sort of project management? Why is it that many software projects exceed their original budgets by two to four hundred percent? In contrast, according to Bennatan (1995), stringent methodology leads to developers' complaints that they spend more time documenting the project than actually writing code.

A 1997 study by KPMG sheds some light on the factors contributing to IT project failure. They defined failure as one or more of the following: a) the project budget was overrun by at least 30%, b) the project schedule was overrun by at least 30%, or c) the project was cancelled or deferred or did not produce the benefits it was expected to produce.

The most common type of project failure that they found was overrunning the project schedule (reflecting 87% of the failed projects).

The study revealed that there were three common reasons that projects failed: 1) There was poor project planning, 2) a weak business case and 3) lack of top management involvement and support. Other reasons for failure discovered in the study were a) many projects used new or unproven technology and b) vendors did not

meet their commitments. This study was conducted among chief executives in 1450 public and private sector organizations across Canada. As previously discussed, given that the perception of success or failure of a project can be different depending on who the respondents are, in this case, given that they were executives, time and money were the main determinants. It is interesting to note that, perhaps, had the study dealt with respondents including users and developers, the perception of failure, to begin with, may not have been the same.

Similarly, other studies of IT project implementation have proposed factors leading to IT project success including top management support, business plan and vision, effective communication, project management, and business process reengineering (Nah et al., 2001; Nah et al., 2003). The Standish Group (1999) suggested that the smaller, shorter, and less expensive projects were more likely to succeed that those that were larger, more expensive, and longer.

After reviewing the academic literature, to the best of our knowledge, there have been no studies that have formally examined the impacts of Pinto and Prescott's (1988) ten critical success/failure factors on IT projects specifically. This is exactly what the present study undertakes. We suspect that the results will add value to our understanding of the factors contributing to IT PM success. Furthermore, given that we test a proposed model, the results may also provide practical insight to project team leaders insofar as deciding which elements to better control in order to enhance the probability of success in IT Project Management.

The sections that follow will present the conceptual model used in the present study, the specific hypotheses, the methodology undertaken, as well as the results of the study.

Chapter 2 Conceptual Model and Hypotheses

In light of the high rate of failure of IT/IS projects, our study attempts to further clarify the impact of the critical success factors in generic Project Management, on IT projects in particular.

The conceptual model used in our study has been adapted from Belout (1998 and 2004), which, in itself, is an adaptation of the Pinto and Prescott (1988) theoretical model. **Figure 5**[12], on page 50, presents Belout`s 1998 model.

Both models (Belout, 1998; Pinto and Prescott, 1988) identify *ten critical factors*, which determine success in project implementation. The latter also served to select the independent **variables** in our proposed study. They include: 1) Project Mission, 2) Project Schedule/plans, 3) Client consultation, 4) Technical Tasks, 5) Client Acceptance, 6) Monitoring and feedback, 7) Communication, 8) Trouble-shooting, 9) Top management support and 10) Personnel.

As depicted in **Figure 5**, on page 50, the model also includes two **moderating variables**, namely: 1) *Project Life Cycle* (based on Pinto and Prescott, 1988) and 2) *Project Structure* (based on Belout, 1998 and Belout and Gauvreau, 2004).

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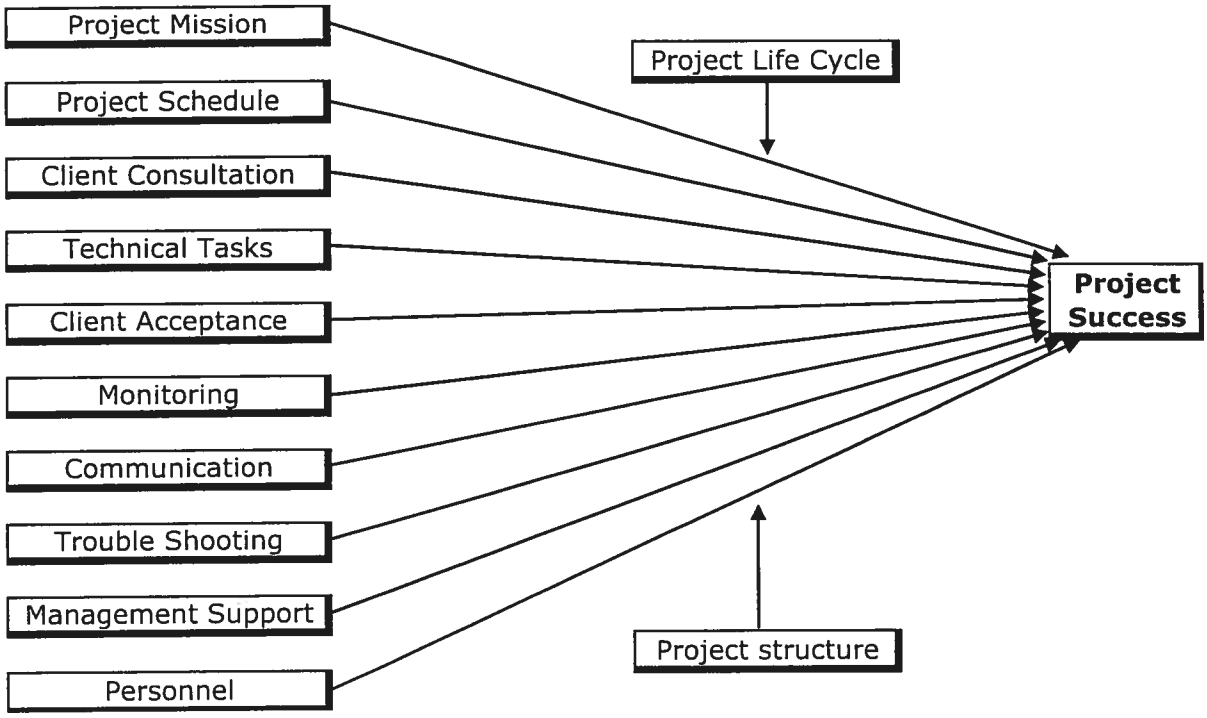
[12] From Belout, A., *Effects of Human Resource Management on Project Effectiveness and Success: Toward a New Conceptual Framework*, International Journal of Project Management, Vol. 16, No. 1, p. 24, 1998.

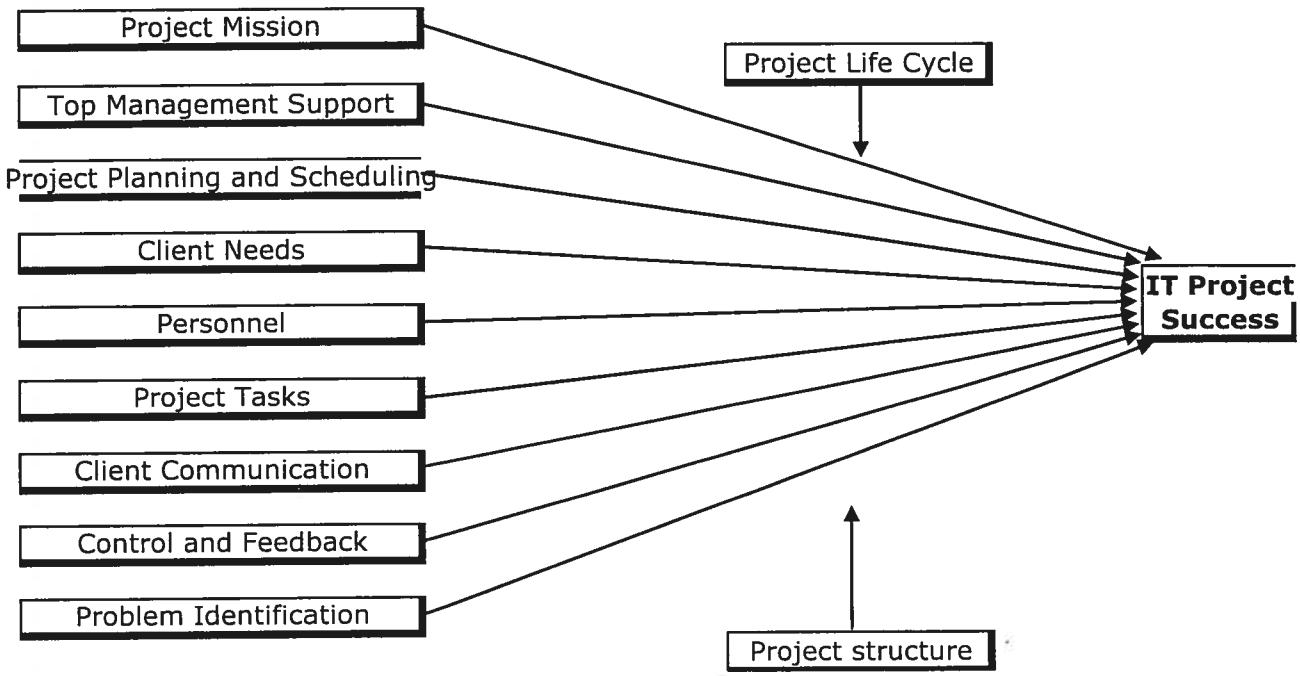
Figure 5: Belout's Model (1998)



There are two basic differences between the conceptual model used in this study, depicted in **Figure 6**, on page 51 and Belout's model. One of the these differences is the fact that our model has only nine (9) independent variables, rather than then ten (10) originally proposed by Belout. In fact, as in Belout's 2004 study, the Client Consultation and the Communication variables were merged into one variable due to multicollinearity.

The second difference between the current model and Belout's previously reported work is adaptation of the independent variable to an IT context. The latter represents an important innovation as no previous studies of this or similar natures have been conducted before.

Figure 6: Theoretical Model



Based on the results reported in the literature as well as observations and personal familiarity with the IT industry, the following hypotheses have been formulated and provide the overall framework for this study:

H1: The nine (9) success factors, (i.e. the independent variables) will have a significant impact on IT project success (the dependent variable).

H2: The project life cycle (conceptualization, planning, execution or termination) moderates the relationship observed between the success factors (the independent variables) and project success (the dependent variable).

H3: Project Structure (functional, projectized or matrix) moderates the relationship observed between the success factors (the independent variables) and project success (the dependent variable).

Chapter 3 Methodology

3.1 Questionnaire and Data Collection

The data for this study was collected by means of a self-administered questionnaire, a variation of Slevin and Pinto's 1986 P.I.P. (*Project Implementation Profile).* The P.I.P:

> "...requires participants to indicate their degree of agreement on a 7-point Likert scale to a series of 50 questions covering the 10 critical factors...each factor is comprised of five sub-items. The instrument's measure of project success is an aggregate of 13 items. These multiple items assess project success based on a variety of criteria, including adherence to budget and schedule, perceived quality and utility of the final project, client satisfaction with the project, and their likelihood of making use of the finished project" (Pinto and Prescott, 1998, p.10).

The questionnaire that was used in this study is included in **Annex 1.** It is an adaptation of Slevin and Pinto's 1986 P.I.P. Since this study is based on Belout and col., 2004, the questionnaire that we used is identical to the one used by Belout and col. in 2004.

The questionnaire used in this study was selected for various reasons. First and foremost, it is the same questionnaire that was used in the study conducted by Belout and Gauvreau in 2004. We used this same questionnaire so that the current methodology would be consistent with the one that they used and so that we could follow the same methodology and do the same statistical analyses. Our objective was to follow their model as closely as possible, and only to change the dependendent variable to Project Success.

There are also additional general benefits to using a questionnaire as a research tool. Firstly, questionnaires a cost effective tool, particularly for large samples. The data is also easy to analyze as it can be entered as quantitative data into computer packages

like SPSS. Thirdly, there is no researcher bias as the respondent cannot be influenced by the researcher (through visual cues or otherwise) while completing the questionnaire. Finally, the questionnaire is a non-intrusive tool where the respondent can complete it uninterrupted, at his/her own leisure (Creswell, 1994; Dillman, 2000; Mathers et al., 2002)

The questionnaire used in the present study, previously validated by Belout (1998), is comprised of four sections:

1) General information about respondents (socio-demographic characteristics).
2) Descriptive information about the Project (the nature of the project selected that serves as the context for the remaining sections of the questionnaire).
3) The success factors (the presence or absence of certain success factors in the project's implementation).
4) The overall success of the project (respondents must assess the outcome, i.e. success/failure of the project in question).

To ensure that we only target IT projects, we only retained those questionnaires where respondents answered that they worked in either an Information Technology or a Technology Development business area. This is addressed in Section 2, question 5 of the questionnaire (Annex I, p. vii). Section 2 of the questionnaire also provides information with respect to the moderating variables of *Project Life-Cycle* and *Project Structure*. Regarding *Project Life-Cycle*, respondents are asked to indicate in *which* phase of the *Project Life-Cycle* they were involved. Regarding *Project Structure*, respondents are asked to indicate, from a choice of several organizational structures, in which their project team operated.

The independent variables (the critical success factors) were measured in section 3 of the questionnaire. Each of the ten factors is measured by five to eleven (5-11) indicators to which respondents must agree or disagree on a seven (7) point Likert scale ranging from one (1) strongly disagree, to seven (7), strongly agree. In

order to compare the variables, responses to the various indicators will be compiled to generate a total score of each respondent for each variable.

Section 4 of the questionnaire measures the dependent variable, *IT Project Success.* Like with the independent variables, respondents are asked to rate their level of agreement on a seven (7) point Likert scale along nine (9) dimensions or indicators of project success in order to determine an overall assessment of project success.

The data was collected by distributing the questionnaire by hand, mail, and e-mail to two hundred and ten (210) important project team members, working mainly in Quebec-based, private sector companies. Approximately sixty five (65) of the respondents were approached and sourced through a business database belonging to a Montreal-based IT recruiting firm. Another one hundred or so (100) respondents were solicited with the collaboration of HR professionals belonging to the ORHRI (Ordre des conseillers en resources humaines et en relations industrielles agréés du Québec) who work in IT environments. These HR professionals collaborated with us to solicit respondents from their colleagues in IT. Finally, the remaining respondents were solicited through direct mailings to Quebec-based industrial sector engineering, consulting, and construction organizations, as well as hand-distributed to participants in project management seminars financed by the Word Bank, ACDI and Africa Development Bank.

3.2 Population and Sample

The questionnaire was completed by professionals who were significantly involved in IT Project implementation (as screened by the questionnaire). Given the variety of methods of soliciting respondents, as well as the small community of IT professionals in the Montreal area, we believe our population to be a scientific representation of

project managers and important project team members of IT projects. Nonetheless, our sample was a sample of convenience.

Of the two hundred and ten (210) project team members and project managers approached in IT project management, One hundred and thirty one (131) people completed the questionnaire, a response rate of 62.4% (n=131).

3.3 Data Analysis

In order to test the hypotheses we will use both bivariate correlations and regression analyses. With respect to the bivariate correlations, we will look at the correlations between each of the independent variables and the dependent variable of IT project success. These correlations will allow us to comment on whether there is a relation between each of the independent variables and the dependent variable.

Furthermore, we will also examine the bivariate correlations between each of the independent variables and the dependent variables, controlling for the moderating variables. In other words, we will examine these correlations in each of the project phases, as well as with each project structure. This will allow us to see whether, when controlling for phase and structure, the correlation between the independent variables and the dependent variable is affected.

Once the bivariate correlations are complete, we will proceed to a regression analysis. Our first regression analyis will examine all the variables, irrespective of project phase or project structure. The regression analysis will reveal the relative impact, if any, of the independent variables in explaining the variance in the regression model.

To assess the effect of the moderating variables on the model, we will further do regression analyses at each project phase, and with each project structure to see

whether the moderating variables will influence the effect that the independent variables may have in the variance of the model.

All of the data will entered and analyzed using SPSS for Windows.

Chapter 4 Results

This section presents the results of the statistical analyses that were performed in order to verify the hypotheses presented in the previous section.

4.1 Sample description

Aside from providing information regarding the dependent, independent and moderating variables in the study project (to be discussed later); the questionnaire also gathered information about some personal characteristics of the people responding. This type of information has been summarized in order to better understand some of the general characteristics of the sample. Additionally, information on the type of project, the project cost, and the location where the project took place, is reported.

As for the sample general characteristics, the following should be noted. The majority of the sample, 58.8%, was between the ages of 35 and 44, having worked with the organization where the project was conducted between several months and thirty two (32) years. 77% of the sample worked with their particular organization for less than ten (10) years. 67.9% of the respondents were university graduates having at least a bachelor degree.

With reference to the project descriptions, 62.6% of the sample described projects where the cost was above $400 000. The projects were divided relatively equally between in-house projects (49.6%) and contract projects (43.5%). 82.5% of the projects were conducted in Canada, where the large majority were conducted in Quebec (67.2%).

4.2 Measures and Operational Model

4.2.1 The Moderating Variables

Regarding *Project Life-Cycle*, respondents were asked to indicate in *which* phase of the *Project Life-Cycle* they were involved. They had the following four *Project Phase* choices: a) Initiation, b) Planning, c) Execution and d) Closing.

Regarding *Project Structure*, respondents were asked to indicate, from a choice of three (3) organizational structures, in which their project team operated. The three choices were a) Functional Organization, b) Projectized Organization, or c) Matrix Organization. Respondents who said that they worked in a Matrix Organization then had to further specify a sub-type of Matrix Organization. The options were: a) Strong (Project) Matrix Organization, b) Weak (Functional) Matrix Organization or c) Balanced Matrix Organization.

Project Life Cycle

Table II on page 58 shows the breakdown of responses by phases of Project Life Cycle.

Table II: Sample Breakdown by Project Phase

Phase	N
Conceptualization	19
Planning	19
Execution	90
Termination	2
Missing values	1
Total	**131**

The majority of the respondents (68.7%) described projects that were in the *Execution* phase where only 1.5% described projects in the *Termination* phase.

14.5% of respondents described projects in the *Conceptualization* phase. Similarly, the remaining 14.5% of respondents described projects in the *Planning* phase.

Given the small number of individuals who participated in certain project phases (n<30), it has been decided to group the first two phases together to comprise one variable, and to group the second two phases together to comprise one variable. The *Conceptualization* phase was grouped with the *Planning* phase (n=38), and the *Execution* phase was grouped with the *Termination* phase (n=92). In grouping the variables together, the two new variables still reflected project phases, as one variable reflects the beginning of the project, while the other reflects the end of the project. This is similar to the two phases proposed by Pinto and Mantel (1990) who proposed that project life cycle can be viewed in two phases, the Strategic phase, relating to development and the Tactical phase relating to execution.

Project Structure

Table III, on page 59, shows the breakdown of responses by Project Structure.

Table III: Sample Breakdown by Project Structure

Structure	N
Functional	23
Projectized	40
Matrix	68
Missing values	0
Total	**131**

17.6% of respondents carried out their projects in a *Functional* structure, while 30.5% were in a *Projectized* structure. 51.9% of the respondents worked in a *Matrix* structure.

For our statistical analysis, although The *Functional* structure contained few people (n=23), we kept the three types of structures distinct, rather than grouping the *Functional* structure with another structure. We suspected that there is something to

explore with this moderating variable, and that combining it with another, would not be adequate, particularly since Project Structure is a Discrete variable.

4.2.2 The Independent and Dependent Variables

The independent variables were borrowed from Pinto and Prescott's (1988) critical success factors. They were measured by five to eleven (5-11) items on a seven (7) point Likert type scale ranging from one (1) strongly disagree, to seven (7), strongly agree.

The dependent variable, *IT Project Success*, was also measured on a seven (7) point Likert scale along nine (9) dimensions.

Reliability of the Independent Variables

Prior to using the variables in subsequent analyses, a reliability test of item homogeneity per construct was performed.

The statistical measure that was selected to test for this internal consistency is Cronbach's Alpha. It is recommended to sue this statistical measure of internal consistency when doing analyses on appreciation scales such as Likert's (Kaplan and Saccuzzo, 1993, p.115). Since certain variables had a large variance, it has been decided to use the standardized Alpha coefficient. Most researchers in the social and behavioural science agree that if the standardized Alpha measure is higher than .70, then the variable can be considered homogenous (Darren and Mallery, 1999; Nunnally, 1978). If a variable is homogenous then we can create a construct value for each variable that is a reflection of the mean of its dimensions.

The measures of homogeneity are presented in Table IV on page 61.

Table IV: Measures of Homogeneity of each Construct

Type of Variable	Name of Variable	Number of Items	Number of Cases	Cronbach's Alpha Measure
Independent Variables	1. Project Mission	10	130	.849
	2. Top Management Support	10	131	.881
	3. Project Planning and Scheduling	8	130	.866
	4. Client Needs	5	129	.835
	5. Personnel	9	130	.669
	6. Project Tasks	10	130	.832
	7. Client Communication	11	128	.926
	8. Control and Feedback	10	129	.908
	9. Problem Identification	10	129	.891
Dependent Variable	10. Project Success	9	125	.753

Results indicated that each of the independent variables, were, indeed, homogenous, with alpha coefficients of .80 or higher, with the exception of the Personnel independent variable (alpha = .669). After closer inspection of the dimensions that were a priori considered for the Personnel construct it had been noted that one item, namely the dimension relating to manpower forecast, was the cause for relatively low reliability and it has therefore been eliminated. The remaining eight (8) items were subsequently used to compute the Personnel variable and the alpha value was improved from .669 to .866.

Variance and Distribution Characteristics

Once the constructs for each variable were created, we were able to look at the frequency distribution for each variable. We found that, despite the fact that the variables were all normally distributed, the majority of them were asymmetrically skewed to the right, indicating that on average most people responded that they were

in agreement with the statements (A histogram of the frequency distribution for the dependant variable is presented in Annex 2).

4.2.3 Hypothesis Testing

To test the three hypotheses proposed, the first analysis performed was bivariate Pearson correlations between each of the independent variables and the dependent variable (Project Success). These correlations, at first, did not take the moderating variables of Project Life Cycle and Project Structure into account. Subsequently, correlations were calculated under in each stage of Project Life Cycle and in each Project Structure to determine their moderating effects on the correlation between the independent variables and the dependent variable. Finally, a regression analysis was performed to determine the impact of all the independent variables on Project Success.

Bivariate Correlations

In order to see whether there is a relationship between each of the independent variables and the dependent variable, the subject of our first hypothesis, which states that the nine (9) independent variables will have a significant impact on project success, we began by performing bivariate correlation analyses. See Table V, on page 63, for the Bivariate Correlation Table of the nine success factors (the independent variables) and the measure of success (the dependent variable).

For the bivariate correlations in Table V, on page 63, the Pearson correlation method was used. This method measures the degree of linear relationship between two quantitative, continuous variables (Kaplan and Saccuzzo, 1993). Nevertheless, scientists accept the use of ordinal variables as well with the Pearson method. Given that Pearson's method requires a sample of reasonable size ($n>30$) and the variables must be normally distributed, the independent and dependent variables meet the criteria for using Pearson's method.

The bivariate correlation analyses will also serve as the starting point for the regression analysis, to be discussed later.

Table V: Bivariate Correlations

Variable	Mission	Support	Planning	Needs	Personnel	Tasks	Communication	Control	Problem	Success
Mission	1 p=. N=130									
Support	.642 p=.000 N=130	1 p=. N=131								
Planning	.454 p=.000 N=129	.554 p=.000 N=130	1.000 p=. N=130							
Needs	.491 p=.000 N=128	.488 p=.000 N=129	.451 p=.000 N=129	1 p=. N=129						
Personnel	.420 p=.000 N=129	.498 p=.000 N=130	.598 p=.000 N=130	.510 p=.000 N=129	1 p=. N=130					
Tasks	.487 p=.000 N=129	.508 p=.000 N=130	.549 p=.000 N=130	.578 p=.000 N=129	.580 p=.000 N=130	1 p=. N=130				
Communication	.521 p=.000 N=127	.536 p=.000 N=128	.641 p=.000 N=128	.697 p=.000 N=128	.679 p=.000 N=128	.638 p=.000 N=128	1 p=. N=128			
Control	.519 p=.000 N=128	.620 p=.000 N=129	.759 p=.000 N=129	.495 p=.000 N=128	.630 p=.000 N=129	.624 p=.000 N=129	.691 p=.000 N=128	1 p=. N=129		
Problem	.459 p=.000 N=128	.581 p=.000 N=129	.606 p=.000 N=129	.551 p=.000 N=128	.568 p=.000 N=129	.608 p=.000 N=129	.638 p=.000 N=128	.710 p=.000 N=129	1 p=. N=129	
Success	.497 p=.000 N=124	.534 p=.000 N=125	.416 .000 N=125	.379 p=.000 N=124	.496 p=.000 N=125	.447 p=.000 N=125	.456 p=.000 N=124	.459 p=.000 N=125	.610 p=.000 N=125	1 p=. N=125

H1: The Correlation between the independent variables and Project Success

The bivariate correlation matrix confirms that with respect to our first hypothesis, the independent variables have an impact on Project Success. Each of the independent variables shows moderate to strong correlation with the dependent variable.

Table VI, on page 64, shows the Pearson bivariate correlations between each of the independent variables (IV) and the dependent variable, Project Success.

Table VI: Bivariate Correlations - IV and Project Success

Pearson Bivariate Correlations (p=.01; n>124) Independent Variable and Overall Project Success	
	Overall Project Success
1. Project Mission	r = .497
2. Top Management Support	r = .534
3. Planning and Scheduling	r = .416
4. Client Needs	r = .379
5. Personnel	r = .496
6. Project Tasks	r = .447
7. Client Communication	r = .456
8. Control and Feedback	r = .459
9. Problem Identification	r = .610

As can be observed in Table VI, on page 64, the independent variable that showed the smallest correlation with the dependent variable was Client Needs (r=.379, p=.01), while the greatest correlation was with Problem Identification (r=.610, p=.01). Nonetheless, even to a certain degree, all of the independent variables were correlated with Project Success.

Reducing co-linearity and choosing a minimal set of Independent variables

Although the variables proved to be homogenous as per the alpha coefficients for each variable, an examination of the correlation matrix of the variables (see Table V on page 63) also revealed moderate to high correlations among some of the independent variables. To ensure that each variable measured one construct, an exploratory factor analysis was performed for all nine (9) independent variables and the dependent variable. This extraction method, when used in its varimax option,

attempts to find minimal orthogonal factors and discover a new underlying structure that can be used in subsequent analyses. This will be further discussed in the operation considerations for the regression analysis.

The Correlation between the independent variables

Table VII, on page 66, highlights the problem relating to high levels of correlation between the independent variables. A correlation greater than .20 but less than .30 constitutes a weak correlation, while a moderate correlation is represented by coefficients between .30 and .40. We noted that many of the independent variables had correlation coefficients that were .50 and higher. To us, this identified an issue of multicollinearity. The variables that had this high correlation (of .50 or higher) are displayed in Table VII, on page 66.

Table VII: Correlation between the IV

Pearson Correlation Coefficients r≥.60 ; p=.01		
	r≥60; p=.01	r≥50 but ≤.60 ; p=.01
Project Mission and Top Management Support :	r = .642	
Project Mission and Client Communication:		r = .521
Project Mission and Control and Feedback:		r = .519
Top Management Support and Control and Feedback	r = .620	
Top Management Support and Project Planning and Scheduling		r = .554
Top Management Support and Project Tasks		r = .508
Top Management Support and Client Communication		r = .536
Top Management Support and Problem Identification		r = .581
Project Planning and Scheduling and Client Communication	r = .641	
Project Planning and Scheduling and Control and Feedback	r = .759	
Project Planning and Scheduling and Problem Identification	r = .606	
Project Planning and Scheduling and Personnel		r = .598
Project Planning and Scheduling and Project Tasks		r = .549
Client Needs and Client Communication	r = .697	
Client Needs and Personnel		r = .510
Client Needs and Project Tasks		r = .578
Client Needs and Problem Identification		r = .551
Personnel and Client Communication	r = .679	
Personnel and Project Tasks		r = .580
Personnel and Problem Identification		r = .568
Project Tasks and Client Communication	r = .638	
Project Tasks and Control and Feedback	r = .624	
Project Tasks and Problem Identification	r = .608	
Client Communication and Control and Feedback	r = .691	
Client Communication and Problem Identification	r = .638	
Control and Feedback and Problem Identification	r = .710	

As illustrated in Table VIII, on page 67, the following variables were very highly correlated with other independent variables, given the number of times where correlation coefficients were greater than or equal to .50:

1) Project Tasks

2) Client Communication

3) Control and Feedback

4) Problem Identification

These variables thus required particular attention when doing the regression analysis, to be discussed later. Table VIII, on page 67, shows the number of instances where each variable was highly correlated with another ($r \geq .50$).

Table VIII: Instances of High Correlation between the IV

Instances of Correlation (coefficients) for the Independent Variables Pearson $r \geq 50$; $p = .01$; $n > 124$			
	$r > .60$; $p = .01$	**$r > .50$ but $r \leq .60$; $p = .01$**	**Total**
Project Mission	1	2	3
Top Management Support	2	4	6
Planning and Scheduling	3	3	6
Client Needs	1	3	4
Personnel	2	4	6
Project Tasks	3	4	7
Client Communication	6	2	8
Control and Feedback	6	1	7
Problem Identification	4	3	7

H2: Project Life Cycle as a Moderating Variable

To test the second hypothesis, that *Project Life Cycle* has a moderating effect on the relationship between the independent variables and the dependent variable, it was decided to do a correlation analysis between each independent variable and the dependent variable of Project Success, under the control of the different phases of Project Life Cycle. To re-iterate, given the small number of respondents in the four phases of Project Life Cycle, the first two phases of Project Life Cycle (*Conceptualization* and *Planning*) were grouped together to form one phase, while the second two phases of Project Life Cycle (*Execution* and *Termination*) were grouped to form a another phase. The two new phases are quite similar to those proposed by Pinto and Mantel (1990). Table IX, on page 68, shows the correlation matrix of each independent variable with the dependent variable of Project Success under the control of the two project phases.

Table IX: Correlations between IV and Success Controlling for Phase

	Mission	Support	Planning	Needs	Personnel	Tasks	Communication	Control	Problem
Conceptualization/Planning									
Success	.633 p=.000 N=35	.762 p=.000 N=35	.449 p=.000 N=35	.313 p=.000 N=35	.527 p=.000 N=35	.481 p=.000 N=35	.470 p=.000 N=35	.592 p=.000 N=35	.543 p=.000 N=35
Execution/Termination									
Success	.442 p=.000 N=88	.411 p=.000 N=89	.478 p=.000 N=89	.435 p=.000 N=88	.493 p=.000 N=89	.462 p=.000 N=89	.457 p=.000 N=88	.426 p=.000 N=89	.671 p=.000 N=89

In both phases of the *Project Life Cycle* all the independent variables remained correlated with overall Project Success, although to varying degrees.

In the *Conceptualization/Planning* phase, the strongest correlation observed was between Top Management Support and Project Success (r=.762, p=.01). Mission also showed a strong correlation with Project Success in this phase (r=.633, p=.01). Control and Feedback, Problem Identification, and Personnel also showed to be rather highly correlated with overall Project Success. The rest of the variables showed moderate correlation with Project Success in this phase, with Client Needs showing the weakest correlation with Project Success (r=.313, p=.01).

In the *Execution/Termination* phase, all of the independent variables remain at least moderately correlated with Project Success. The only variable, however, to emerge as being highly correlated with Project Success is Problem Identification (r=.671, p=.01). It is interesting to note that Top Management Support was most highly correlated with Project Success in the *Conceptualization/Planning* phase, but of all the variables, showed the weakest correlation with Project Success in the *Execution/Termination* phase.

When controlling for *Project Life Cycle*, all the variables still remained, across both phases, correlated with Project Success. On the basis of these first bivariate correlation results, we observe differences in the r across project phases. Therefore, we can conclude that the pattern of correlation is quite different.

H3: Project Structure as a Moderating Variable

To test the third hypothesis, that *Project Structure* has a moderating effect on the relationship between the independent variables and the dependent variable, it was decided to do another correlation analysis between each independent variable and the dependent variable of Project Success, under the control of each of the three *Project Structures*. In this case, it was decided to use Spearman's rank correlation rather than Pearson's correlation coefficient. The reasoning behind this is that Spearman's' rank correlation is typically used in instances where the data is not normally distributed (Kaplan and Sacuzzo, 1993, p.84). When the sample of respondents was divided into the three different Project Structure categories, the number of respondents in the Functional Structure alone became quite small (N=22). With such a small number of cases, we suspected that the distribution would be less likely to be normal, which is why Spearman's rank correlation was used. Table X, on page 69, shows the correlation matrix of each independent variable with the dependent variable of Project Success under the control of the three *Project Structures*.

Table X: Correlations between IV and Success Controlling for Structure (Spearman's Rho)

	Mission	Support	Planning	Needs	Personnel	Tasks	Communication	Control	Problem
Functional									
Success	.369 Sig.091 N=22	.378 Sig.083 N=22	.533 Sig.011 N=22	.398 Sig.067 N=22	.566 Sig.006 N=22	.386 Sig.076 N=22	.623 Sig.002 N=22	.478 Sig.024 N=22	.674 Sig.001 N=22
Projectized									
Success	.432 Sig.008 N=36	.583 Sig.000 N=37	.594 Sig.000 N=37	.594 Sig.000 N=37	.622 Sig.000 N=37	.577 Sig.000 N=37	.527 Sig.001 N=37	.746 Sig.000 N=37	.703 Sig.000 N=37
Matrix									
Success	.370 Sig.002 N=66	.440 Sig.000 N=66	.335 Sig.006 N=66	.399 Sig.001 N=66	.400 Sig.001 N=66	.408 Sig.001 N=66	.438 Sig.000 N=66	.385 Sig.001 N=66	.589 Sig.000 N=66

In all three Structures, all of the independent variables still show moderate to high correlations with Project Success. In the Functional Structure, both Client Communication and Problem Identification showed high correlations with Project Success, while the correlations between Project Success and the rest of the

independent variables remain moderate. In the Functional Structure, Project Mission shows the weakest correlation with Project Success of all the variables.

The Projectized Structure shows even more pronounced correlations with Control and Feedback, Problem Identification, and Personnel all highly correlated with Project Success. Although still moderately correlated with Project Success, Project Mission shows the weakest correlation with in the Projectized Structure.

Finally, in the Matrix Structure, again, all of the independent variables are still, at least moderately correlated with Project Success, with the strongest correlation being between Problem Identification and Project Success. In all three Project Structures, Problem Identification emerged as being one of the variables that had the strongest correlation with Project Success. In the Matrix Structure, Planning and Scheduling and Project Mission were among the variables least strongly correlated with Project Success.

The Impact of all the Independent Variables on Project Success - Regression analysis

In order to determine the relative impact of each of the nine (9) independent variables in Project Success, a regression analysis was performed. However, prior to performing the regression analysis, we needed to ensure that we addressed the problem of multicollinearity. Since there was a great deal of multicollinearity between the independent variables, in order to avoid unduly inflating the r^2 value, we needed to re-assess and revise which variables would be included in the regression model.

Operational considerations

We envisioned two possible ways of addressing the multicollinearity issue: 1) performing a factor analysis and 2) subtracting variables from the model.

The factor analysis

The purpose of the factor analysis was to test whether our questionnaire actually measured nine (9) constructs. Given that many of the independent variables had correlations coefficients greater than .50 between them, we suspected that the questionnaire measured less than nine (9) variables. To our surprise, the factor analysis revealed even more than nine (9) components. In fact, it revealed fourteen (14). It was done for the seventy three (73) questions that measure the independent variables. Table XI, on page 72, presents the total variance explained by each of the components. Rather than reducing the matrix, the number of components that emerged practically doubled (14 rather than 9). Although, it appears as though only three of these components (18%, 10%, 8%) are important in showing a strong variance compared with the other factors (these three components demonstrated 44% of the cumulative variance). Although this does not necessarily mean that our original nine (9) independent variables are not potential determinants of project success, the analysis shows us that there may be another typology that is more detailed and laborious.

Table XI: Factor Analysis

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	18.110	21.819	21.819	18.110	21.819	21.819
2	9.886	11.910	33.729	9.886	11.910	33.729
3	8.222	9.906	43.635	8.222	9.906	43.635
4	6.999	8.432	52.067	6.999	8.432	52.067
5	6.521	7.856	59.923	6.521	7.856	59.923
6	6.048	7.286	67.210	6.048	7.286	67.210
7	5.158	6.215	73.424	5.158	6.215	73.424
8	4.721	5.688	79.112	4.721	5.688	79.112
9	4.233	5.100	84.212	4.233	5.100	84.212
10	3.535	4.259	88.471	3.535	4.259	88.471
11	2.945	3.548	92.019	2.945	3.548	92.019
12	2.365	2.850	94.869	2.365	2.850	94.869
13	2.054	2.475	97.344	2.054	2.475	97.344
14	1.708	2.058	99.402	1.708	2.058	99.402

Extraction Method: Principal Component Analysis.

Despite the factor analysis, and given that it identified even more components, we elected to retain our nine (9) original independent variables as, nonetheless, they were determined to be homogenous based on Cronbach's Alpha measures.

Subtracting Variables from the Model

The decision as to which variables to include in the regression model was made based on the instances of intercorrelation between the variables (See Table VIII on page 67). The process that we used consisted of identifying those variables that that were strongly correlated ($r \geq .50$, $p = .001$). We then calculated the number of times that this sort of strong correlation appeared for each of the variables.

The instance of correlation analysis for the correlation coefficients greater than or equal to .50 showed (as mentioned above) that the following four variables were most strongly inter-correlated: 1) Project Tasks, 2) Client Communication, 3) Control and Feedback and 4) Problem Identification. We therefore decided to remove these four (4) variables from the regression model. This left us with the remaining

five (5) independent variables. These are: 1) Project Mission, 2) Top Management Support, 3) Client Needs, 4) Planning and Scheduling, and 5) Personnel.

Both Belout and Gauvreau (2004) and Pinto and Prescott (1988) were faced with the challenge of multicollinearity and elected to remove some of the most highly inter-correlated variables from their analysis. Furthermore, two of these variables (Client Communication and Control and Feedback) were variables that were also removed by Belout and Gauvreau (2004).

The Regression Model

In this section we will discuss the way the data included in the analysis was treated and we will present the results of the regression analysis.

The regression was done using SPSS for Windows. The analyses were done using the "missing listwise deletion" mode. This method for treating missing values allows for a more accurate representation of the phenomenon observed, as a case is immediately eliminated if it has a missing value for any of the variables included in the regression.

For the regression analysis, the "stepwise" mode was used allows the researcher to determine only those variables that significantly explain the variance in the r^2. The first regression analysis was done for all *Project Life Cycle* phases together, while the subsequent two regression analyses were done for each of the two combined phases of *Project Life Cycle.* Table XII, on page 74, shows the results of these three regression analyses.

There was no regression analysis performed for each of the three *Project Structures*. We felt that we could not do a regression analysis for each Structure, as the sample size for the Functional and the Projectized Structures was too small for a regression analysis with five variables.

Table XII: CSF as per the Regression Analysis using the Stepwise Mode

Project Phase	N	CSF	R^2	F	Sig. F	Constant
All Project Phases	122	Support	.28	47.18	.000	.000
	121	Personnel	.35	32.53	.000	.000
Conceptualization/Planning Phase	34	Support	.58	45.75	.000	.035
Execution/Termination Phase	86	.Personnel	.24	27.24	.000	.000
	85	Mission	.30	18.27	.000	.004

As can be observed, we found that in with all Project Phases together, Top Management Support and Personnel were significantly related to success, with an r^2 value of .35. The majority of the variance was explained by Top Management Support, which had an r^2 value of .28 alone.

In the *Conceptualization/Planning* phase, Top Management Support remained significant in explaining 58% of the variance in the regression model. These results, however, must be interpreted with caution as the sample size of relevant cases was quite small (N=34).

Finally, in the *Execution/Termination* phase, Personnel and Project Mission were the factors that emerged to be significantly related to success with the r^2 value being .30 between the two. In these latter phases of the *Project Life Cycle*, Personnel was the dominant factor of the two significant variables with an r^2 value of .24.

Chapter 5 Discussion

In this section, we will discuss the results obtained in the present study and whether our four hypotheses can be accepted or rejected. We will also compare our results to those obtained by Pinto and Prescott their 1988 study, as well as those obtained by Belout and Gauvreau in 2004. Finally, we will discuss the limits of our methodology as well as potential avenues for future research.

5.1 The First Hypothesis

Our first hypothesis alleges that that the nine critical success factors proposed in our model (see Figure 6 on page 51) will have a significant impact on the dependent variable, IT Project Success. This element was measured is two ways. First, by performing bivariate analyses between each independent variable and the dependent variable of IT Project Success to see whether each independent variable is correlated with IT Project Success, and second, by performing regression analyses in order to determine the significance of the impact that these independent variables have on IT Project Success.

The results in Table VI, on page 64, indicate that, in part this first hypothesis was confirmed. In fact, all of the critical success factors were correlated with IT Project Success. The weakest correlation was between Client Needs and IT Project Success (r=.379), which was still a moderate correlation. The strongest correlation observed was between Problem Identification and IT Project success (r=.610).

IT Projects typically take place in environments that are more volatile and subject to greater task complexity and ambiguity (Watts et al., 1999), and greater risk (, Jiang et. al, 2000; KPMG, 1997). Nevertheless, despite this unique element surrounding IT projects, in terms of correlation between the independent variables and the dependent variable of IT Project Success, our results were similar to what was confirmed by Pinto and Prescott's 1988 study. They also found correlations between all of the ten

critical factors they identified and the measure of success. Belout and Gauvreau (2004) also showed that all independent variables were significantly related to the Project Success.

Thus, despite the fact that our sample contained only members of IT project teams (as opposed to both Belout and Gauvreau and Pinto and Prescott), the correlation results confirm that even strictly in IT projects, the nine (9) independent variables proposed in our model seem to be related to overall project success.

The regression model, however, revealed that of the five (5) variables that we were able to include in the regression analysis only Top Management Support and Personnel had a significant impact on IT Project Success. Therefore, based on this finding, our first hypothesis that all the independent variables had a significant impact on Project Success must be rejected.

As four (4) of the nine (9) independent variables were removed from the regression analysis due to high level of multicollinearity, we can, unfortunately, not comment on whether the excluded variables would have a significant impact on overall Project Success. However, the fact that Top Management Support emerged as the dominant significant factor in explaining Project Success is supported by the literature (Akkermans and Van Helden, 2002; Cash and Fox, 1992; Connell et al., 2001; Lester, 1998; Verner et al., 1999). In fact, Akkermans and Van Helden list Top Management Support as their most important Critical Success Factor in ERP (Electronic Resource Planning) implementation (2002). Similarly, in KPMG's 1997 study of failing IT projects, they found one of the most important explanations for project failure was a lack of Top Management Support. Brendler and Loyle (2001) make a case for distinguishing between the existence of Top Management Support and hands on support. They say that "...the difference between informal support and active leadership can be the difference between success and failure" (2001, p.58). Connell et al. (2001) also highlight the concept of leadership claiming that it is the driving force behind success. And again, Verner et al. list High-Level Management

Support as being a major contributor to Project Success, while its absence was a major contributor to Project Failure in software Project Management (1999).

Globally speaking, Top Management Support can be seen as being primordial to any successful project as it is from that support that project teams get their resources for project implementation. The literature and the research confirm that without the Top Management Support backing the project, the project is potentially all for not.

Although not as dominant, Personnel also emerged as one of the variables that was significant in explaining Project Success, although to a much smaller degree than Top Management Support. This is a finding that was notably different from Belout and Gauvreau (2004) who did not find that Personnel had a significant impact on project success. This finding, however, largely supports Belout's (1998) questioning of Pinto and Prescott's (1988) conclusion that "...personnel was not a dominant variable for project success at any of the four life cycle stages" (p.16). In fact, our results demonstrate that within this IT context that the opposite phenomenon appeared. Both in the correlation and the regression analyses, Personnel remained one of the only factors significantly correlated with project success.

We propose that there may be several reasons why Personnel was a significant factor, impacting Project Success in IT specifically. To begin with, according to some researchers, when it comes to highly complex technical projects, the difference between success and failure can come from human factors (Co et al., 1998), project team competence (Akkermans and Van Helden, 2002), and teamwork and composition (Nah et al., 2001). These elements all clearly fall within the Personnel rubric. Since our study is within an IT context, perhaps given the highly technical nature of the work involved the personnel engaged to work on IT projects may, prima faci, require or have certain technical skills and competencies which would favour a successful project. Despite the fact that Pinto and Prescott (1988) found that Personnel did not have a significant impact on Project Success, their contention that

"...qualified personnel are usually the rule rather than the exception" (p.16), may, in fact, explain why in our case Personnel practices proved to be related to Project Success.

Furthermore, particularly in our sample, the majority of the IT respondents were educated people (67.9% were university graduates). According to Co et al.:

> "...since management has to interact with higher-educated and higher-skilled subordinates, management styles tend to shift from didactic towards participative, i.e. managers playing the role of consultants/advisors rather than 'task masters'" (p. 87).

Following this sort of logic, the project team members, can have more of an impact on the project outcome and may be more instrumental and influential in its success.

It is interesting, however, that the impetus for this study stemmed from the high failure rate in IT Projects. However, since the majority of the respondents in our study refer to successful projects, it is hard to make an inference as to whether weak Personnel-related behaviours would contribute to project failure. Perhaps a future research avenue would be to see if Personnel is negatively correlated with IT Project Failure by only examining projects that failed.

Another question then that comes to mind is with reference to the interaction between Top Management Support, the dominant significant factor, and Personnel. Perhaps if the Top Management Support exists, then a project is more predisposed to being successful, and then, even more likely to be successful if effective Human Resource Management (measured by the Personnel factor) practices are in place?

Another explanation for Personnel impacting Project Success may also stem from the convergence of the following three phenomena: 1) the respondents in our study were all important members of the project team of the particular project used as their reference point in the questionnaire. In most cases, these were the actual project managers. 2) A large majority of the respondents in our sample refer to the execution

phase of the project (68.7%). 3) In terms of assessing project success, the majority of the respondents were in agreement with the measures of project success indicating that the perceptions of the majority of our sample was that they worked on successful projects (see Annex 2 - the frequency distribution for the dependent variable). We suspect that these three elements combined can shed light on why Personnel was a variable to emerge as significant in impacting project success. A more detailed explanation follows.

With respect to the measure of success of the project, our sample respondents had the freedom to refer to any project that they liked, and, more often then not, the seemed to refer to successful projects (a mean score of 4.94 on a 7 point Likert scale). Not only were they referring to successful projects, but these were mainly successful projects in the *Execution Phase* (68.7% of the projects in our sample were at the *Execution Phase*). This phenomenon lays the groundwork for why we believe that Personnel played an important role.

In their 1998 study, Pinto and Slevin's results suggest a set of variables that they found to be significant at each phase of the *Project Life Cycle*. At the *Execution Phase*, their results indicated that an additional variable correlated with project success is a variable called *Characteristics of the Project Team Leader*. They define this variable as: "...competence of the project leader (administratively, interpersonally, and technically) and the amount of authority available to perform his/her duties" (1988, p.69). This factor fits into Belassi and Tukel's (1996) classification category called *Factors relating to the Project Manager and Team Members*. The indicators that measure the Personnel factor in our questionnaire, also, all fall into the Belassi and Tukel's category of *Factors relating to the Project Manager and Team Members*. Since our factor analysis confirmed that there were, in fact, fourteen (14) variables in our questionnaire, rather than the nine (9) that we expected, we suspect that among these additional concepts, there may be one a unique variable relating to the Project Manager's Characteristics that is potentially embedded in the Personnel variable.

This is further supported by the literature that supports the notion that Personnel and qualities relating to the Project Manager are important factors relating to project success (Barker, 1999; Cash and Fox, 1992; Jiang et al., 2001; Nah et al., 2001; Pinto and Slevin, 1988). Jiang et al. state that "the project leader has been found to one of the most (if not the single most) critical factors to project success" (2001, p.49). They further concluded that the following Personnel related factors are among the important activities required to promote successful Information Systems project outcomes: "obtain commitment and maintain the involvement of key personnel at all levels" (2001, p.53) and "build an effective team, clearly defining team member roles and creating the team structure" (2001, p.53). These sorts of items were clearly among those measured in the Personnel dimension in our questionnaire.

An avenue for future research in this respect might me to administer a more elaborate measurement tool that distils the elements of Personnel from and Characteristics of the Project Manager. The relationship between the Characteristics of the Project Manager and IT Project Success would be interesting to explore.

We also suspect that there is a potential relationship between the Personnel factor emerging as significant and the element of rater reliability. Literature has indicated that the perception of project failure or success as well as the elements that are important to achieving that success may vary depending on who the rater is (Finch, 2003; Hartman and Ashrafi, 2002; Rad, 2002). There is research that indicates that Project Managers may perceive Personnel to be a more important critical success factor than other stakeholder groups, such as Project Team Members or End Users (Finch, 2003). Perhaps the fact that our sample was comprised of Project Managers also had an impact on the assessment that Personnel was seen as being critical in IT Project Success.

Despite the significance of the correlations, and the significance of the impact of both Top Management Support and Personnel in the regression model, we interpret our results with caution due to two elements:

1) There was an issue of multicollinearity in our study. Although each independent variable was positively correlated with project success, there were many instances where independent variables were also positively correlated with other independent variables. Therefore, it becomes difficult to say with a great deal certainty that each of the nine critical success factors is independently correlated with success. On the other hand, when a variable is demonstrated to be significant, it is an indicator that it is.

2) Although each variable was confirmed for internal consistency by Cronbach's alpha measures, the factorial analysis revealed that, many of the variables were, in fact, multidimensional. For that reason, rather than there being only nine critical success factors, there may be more. Of course, our study was restricted in that it required the use the same measurement tool (a modified version of the P.I.P.) that Belout and Gauvreau used. Although this tool was validated, we question the validity of this tool due to the results of the factor analysis. It would be interesting to delve deeper into constructing a more elaborate questionnaire which divides variables into constructs that each measure only one dimension in order to bring out additional unique variables.

Research also indicates that there may be additional critical success factors affecting project success which were not measure by our questionnaire at all. Examples of some of these factors include procedural factors including the amount of marketing effort deployed by the organization, humanistic factors including the extent to which project team members are motivated, and characteristics of personnel, including the competency of the managers (Brown et al., 2002; Jiang et al, 2001).

The most overwhelming difference between our study and Belout and Gauvreau's (2004) was the fact that Personnel emerged as a critical success factor, where it did not in previous studies (Belout and Gauvreau, 2004; Pinto and Prescott, 1988) using the P.I.P. This leads us to believe that, particularly with reference to IT projects, the impact of Personnel across project phases is one that would be interesting to explore in more detail in future research, perhaps by siphoning out the particular dimensions that measure HRM.

5.2 The Second Hypothesis

In our second hypothesis, we contended that *Project Life Cycle* would have a moderating effect on the relationship between the independent variables and the dependent variables.

We could, unfortunately, not maintain the original four phase life cycle in our model as we did not have enough data to test each phase uniquely. We needed to therefore create two phases, one referring to the first part of the project *(Conceptualization/Planning)* and the second referring to the second part *(Execution/Termination)* of the project. Even in grouping the phases together, it must be noted that a large majority (68.7%) of the sample referred to studies in the *Execution* phase. Even when grouping the phases together, we still did not have much information regarding phases other than the *Execution* phase. It thus becomes difficult for us to draw any sorts of conclusions with respect to the moderating effect of a single phase on the model.

That being said, the first phenomenon that we observed was that, across both the *Project Phases*, all of the independent variables still remained correlated with Project Success. However, the strength of the correlations varied across *Project Phases*. Furthermore, once regression analyses were conducted we noticed that different variables emerged as significantly affecting Project Success, at different *Project Phases*. Furthermore, given the statistics in Table XII on page 74, the pattern of correlation is quite different.

5.2.1 The Conceptualization/Planning Phase

In the *Conceptualization/Planning Phase*, the variables that proved to be most strongly correlated with Project Success were Top Management Support, Project Mission, Control and Feedback, Problem Identification and Personnel. Unfortunately, due to the high levels of multicollinearity, we did not include Control and Feedback and Problem Identification in the regression analysis as these variables were frequently correlated with other independent variables. Therefore, we cannot make further comments with reference to the impact that these variables might have towards the beginning of the *Project Life Cycle*. Top Management Support, again, proved to have a significant impact on Overall Project Success, particularly at the early phases of *Project Life Cycle*. In fact, it was the only variable of those that were most correlated with Project Success to emerge as being significant.

The fact that Top Management Support emerged as a significant variable in the early stages of the Project is certainly in accordance with the literature that states that this support lays the foundation for the entire project (Lester, 1998; Morris, 1988). Previous research (Belout and Gauvreau, 2004; Pinto and Prescott, 1988; Pinto and Slevin, 1988) found this variable to have its most significant impact at the Planning phase, specifically. The logic being that it is at the Planning Phase where resources for the project's execution are released by Top Management (Pinto and Prescott, 1988). Unfortunately, due to the small sample that we had, we had to combine the *Conceptualization* and the *Planning* phases in our analysis, and are unable to make any assertions as to where specifically in the beginning *Project Phases* Top Management can exert its influence.

Furthermore, our sample size, even in the combined *Conceptualization/Planning* Phase was very small (N=34). As such, although Top Management Support emerged as having a rather significant Impact on Project Success at this phase, and that this result is already supported by previous research in Project Management Success (Belout and Gauvreau, 2004; Pinto and Prescott, 1988), we are reluctant to generalize from this result.

5.2.2 The Execution/Termination Phase

In the *Execution/Termination Phase*, although the independent variables were all still correlated with Project Success, we witnessed more moderate correlations. In fact, the only independent variable that showed a very strong correlation with Overall Project Success in this phase was Problem Identification. This variable proved to have significant impact on Project Success in the *Execution Phase* in Pinto and Prescott (1988) as well as in Belout and Gauvreau (2004). The literature suggests that a potential pitfall in IT Projects is the improper identification of project risks (Jiang and Klein, 2001; KPMG, 1997). Given that IT projects are typically more complex and technical, the propensity for risk is even higher. Troubleshooting or Problem Identification can be seen as one of the ways to overcome the risk and while the project is already underway in the *Execution* Phase (Lester, 1998; Nah et al, 2001).

Unfortunately, due to the high correlation that Problem Identification had with many of the other independent variables, we removed it from our regression model and cannot discuss whether Problem Identification would have a significant impact at the *Execution/Termination* phase of a project. It seems, however, given the correlation between Problem Identification and Success at this phase, that it would be an interesting phenomenon to investigate further in the IT domain.

In our regression analysis, the two variables that showed to have a significant impact on Project Success in the *Execution/Termination* phase were Personnel and Project Mission. As mentioned above, the fact that the majority of our sample referred to projects in the *Execution Phase*, and that is the phase where project team members can exert the most influence, we were not surprised at all to find that, in fact, Personnel was the dominant variable in affecting Project Success in this phase. This is different from both Pinto and Prescott's (1988) and Belout and Gauvreau's (2004) results which did not have Personnel emerge as having a significant impact at

any phase. This suggests that perhaps, specifically in the domain of IT, Personnel, particularly at the *Execution* phase of a project is something to look at more closely.

What was also interesting was that Project Mission showed to have a significant impact in the *Execution/Termination* phase only, rather than in earlier phases of the project as well. Belout and Gauvreau found that Project Mission was most significant at the Planning phase and earlier studies have demonstrated (Hartman and Ashrafi, 2002; Pinto and Prescott, 1988; Pinto and Slevin, 1988) that it was a critical factor across Project Phases, indicating that the success of a Project is contingent on never losing sight of the project goals. Given that the literature suggests that Project Mission, particularly in the IT domain is a crucial determinant of Project Success (Hartman and Ashrafi, 2002), we believe that the fact this factor emerged as critical only in the *Execution/Termination* phase is that our sample size was not large enough for us to effectively test the impact of this variable across all project phases.

What we did conclude, however, was that Top Management Support was a crucial variable in early project Phases, while Personnel was significant at later Project Phases, indicating that *Project Phase* certainly has a moderating effect on the relationship between the variables. Most interesting, is that contrary to the Belout and Gauvreau, Personnel emerged as a dominant variable and may require particular attention in IT.

5.3 The Third Hypothesis

Our third hypothesis suggests that *Project Structure,* like *Project Life* Cycle, also moderates the impact of the dependent variables on IT Project Success. Since we did not have a large enough sample in each *Project Structure* to perform a regression analysis, we can only comment on the impact that *Project Structure* had on the correlations observed between the independent variables and IT Project Success.

Within each *Project Structure*, each independent variable remained correlated with IT Project Success, although, much more moderately in some structures than in others. Given the varying strengths of correlations between the variables, we can conservatively confirm the third hypothesis, although we are restricted insofar as being able to comment on which variables had a significant impact in each *Project Structure*.

In the *Functional* Structure, Problem Identification, Client Communication, Personnel and Planning all showed strong correlations with IT Project Success. In the *Projectized* Structure, all of the variables proved to be highly correlated with IT Project Success, with the exception of Mission which showed moderate correlation. Finally, in the *Matrix* Structure, only Problem Identification was very highly correlated with IT Project Success.

We notice that, across project structures, Problem Identification showed strong correlation with IT Project Success, indicating that, in IT Projects, across all structures, this variable may be one that requires considerable attention. Again, this can be related to, as previously discussed, the higher levels of risk and complexity in IT projects in general. Belout and Gauvreau (2004) found similar results with respect to this variable across all structures.

In the *Matrix* structure, Problem Identification was the only variable to show very strong correlation with IT Project Success. We suspect that these results potentially relate to the fact that within the *Matrix* Structure, there were three sub-structures: *Strong*, *Weak*, and *Balanced Matrix* Structures. Perhaps if we would have examined these subdivisions more carefully, we would have seen more pronounced correlations. Or, on the contrary, perhaps when in a *Matrix* structure, it is not the context of the overall organizational structure that is important, but rather, the structure in which the project was carried out. Perhaps there are not three distinct *Project Structures* but rather only a *Functional* to *Projectized* continuum on which projects should be evaluated.

It is interesting to point out again, that Personnel and Problem Identification both emerged as highly correlated with IT Project Success in both the *Functional* and the *Projectized* Structures leading us to believe that these two factors, as discussed in previous analyses, have an important role to play when it comes specifically to IT Project Success, due to specific skills and competencies required to work on highly complex projects typical to the IT environment.

5.4 Limitations

This section will outline some of the limitations in our methodology and certain recommendations for how to avoid these sorts of shortcomings for future research.

One of the limitations of the present study is that it had relied on a conceptual framework and instruments from two previously designed studies. Thus, we were restricted in terms of the variables included in our model, and the measurement tool used. The present study could *only* examine, as independent variables, the critical success factors associated with Project Management, proposed by Pinto and Prescott (1988) and later by Belout and Gauvreau (2004). By contrast, there may be, specifically in the IT context *other* variables that contribute to project outcome. Unfortunately, the present study could not delve deeper into their investigation.

In our study, as well as in Belout and Gauvreau's (2004) and Pinto and Prescott's (1988), there were issues of multicollinearity which leads us to question the validity of the measurement tool we used (a similar questionnaire was used in all three studies). Based on the factor analysis that we performed, we suspect that the questionnaire actually measures more constructs than the nine (9) that we had originally expected. Perhaps the way in which the indicators in the questionnaire were grouped to represent each variable should be subject for further investigation. We propose that the P.I.P. used in this study needs to be re-evaluated in terms of its

validity to test whether, indeed, each set of indicators questions form a single variable construct.

There was also an issue of sample size in our study. Given that we were measuring the interrelation between seventeen (17) variables (nine (9) independent variables, one dependent variable, and seven (7) moderating variables) in our sample size (N=131) we were unable to find enough cases where each of seven (7) moderating variables (four (4) *Project Phases* and three (3) *Project Structures)* for each variable to be statistically tested. We were forced to group the *Project Phases* into two (2) variables rather leaving them as the four (4) individual ones that we wanted to examine. As an example, only two (2) respondents in our study refer to the *Termination* phase of their project. Therefore, it was very difficult to perform any statistical tests on that group of people. For future research, we suggest that a much larger sample of individuals be used in order to ensure that there are enough people who refer to each of the *Project Phases* and *Project Structures.*

There may have been an issue of rater-reliability. The questionnaire was only completed by Project Managers or important members of Project teams. The literature indicates that there may be different perceptions of project success, as well as the perception of critical success factors, by different stakeholder groups (Finch, 2003; Hartman and Ashrafi, 2002; Rad, 2002). Given that our study only included respondents who were IT Project Managers, our results may offer only one perspective. A way to overcome this issue of perception might be to create a stratified sample including project managers, team members, top management and end users.

Despite these limitations, the present study adds values to the body of knowledge dealing with the critical success factors proposed by Pinto and Prescott (1988) and then Belout (1998), and shows that there are certain critical factors that are particularly relevant in an IT context and we were still able to witness the moderating effects of *Project Phase and Structure*.

Chapter 6 Conclusion

The great failure rate in IT projects inspired us to apply a model of critical success factors in Project Management (conceived by Pinto and Prescott (1988) and later adapted by Belout (1998)) to the Information Technology industry. Our goal was to see if there might be certain factors at play in IT project management that required particular attention, and whether these were the same factors that Pinto and Prescott had identified (1988). We suspected that our results would shed some light on the intersection of Project Management, as a management discipline, and the IT industry to serve as an information tool for IT Project Managers, and to contribute to the growing body of research on critical success factors for IT projects.

We hypothesized that the critical success factors identified in our model would have a significant impact on IT Project Success. Our bivariate correlations revealed that, indeed, all the variables were correlated with IT Project Success, although, we must interpret these results with caution as there was noted multicollinearity between many of the independent variables. From an impact perspective, our hypothesis was partly confirmed in that only certain factors emerged as having a significant impact on IT Project Success. Among those variables were Top Management Support, Personnel, and Project Mission.

We also postulated that these success factors would be moderated by *Project Life Cycle* and *Project Structure*. Our analyses confirmed that *Project Phase* absolutely moderated the impact of these variables, with Top Management Support having a more significant impact on Success in early project phases, while Personnel and Project Mission having more significant impacts at the latter project phases. Unfortunately, we could not evaluate the impacts of the variables at different across *Structures* as our sample size was too small to perform regression analyses at each structure.

Personnel was not found to be a significant factor in Pinto and Prescott's 1988 study which was surprising to proponents of human resource management theory (Belout, 1998). Belout and Gauvreau's 2004 study paid particular attention to the Personnel factor, which they suspected may have been underestimated by Pinto and Prescott. However, their results did not confirm that Personnel was a significant factor in determining Project Success. Interestingly enough, in our study, Personnel emerged as one of the dominant factors. Since our study focused only on the IT industry, in light of our results we believe that in IT, given the high level of technical skill required to carry out a successful project, that Personnel, and selecting the right project team may be among the most important. We propose that this variable is one that requires more attention as a critical success factors for future research in IT Project Management.

In their 1988 study, Pinto and Slevin identify additional critical success factors, other than the ones that we explored in our study. Among them was a variable they referred to as *Characteristics of the Project Team Leader*, which they found to be a significant determinant in the *Execution Phase.* There has also been other literature supporting the notion that there are additional critical success factors affecting Project Success (Barker, 1999; Cash and Fox, 1992; Jiang et al., 2001; Nah et al., 2001). We propose that future research is required to more seriously examine *Characteristics of the Project Team Leader* as a critical success factor in IT Project Management.

Our factorial analysis also led us to question the validity of our measurement tool. The analysis revealed fourteen (14) factors, rather than only the nine (9) outlined in our questionnaire. Therefore, we feel that the questionnaire should potentially be re-tested.

What is particularly interesting to note is that respondents to our questionnaire included Project Managers, who mostly referred to successful projects in the *Execution* phase. Given that close to 70% of the sample referred to projects in this

phase, we could not, with certainly assess the impact of the critical success factors across all of the *Project Phase* proposed by Pinto and Prescott (1988) as we did not have a large enough sample of respondents across the four (4) phases in the *Project Life Cycle*.

We also believe that there was an issue of rater-bias in our study as the only people who participated were Project Managers who may have differing perceptions of both Project Success and Critical Success Factors. Future research might address this issue by including other stakeholders such as project team members, clients, and end users.

Furthermore, as in Pinto and Slevin's 1998 study, we feel that it is important to look at both successful **and** unsuccessful projects. Our study left this to the discretion of the respondent and, for the most part, respondents selected successful projects as their reference point. As one can learn from success as much as one can learn from failure, it would be interesting to study a stratified sample of both successful and unsuccessful projects by instructing participants to refer to one or the other.

Due to the high multicollinearity, our sample size, and a potentially problematic measurement tool, we were unable to reveal many of the interrelations between the variables in our conceptual model. However, the significance that we found in the Personnel factor in the *Execution/Termination* phase, can be used as a springboard for future research into the human element factors in IT Project Management. Furthermore, it would be interesting to explore further whether *Top Management Support* is one of the necessary building blocks for successful projects in IT. With further research, those remain to be seen.

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Annex 1 - Questionnaire

Research On the Impact Of Various Factors, On the Success of Projects

Questionnaire

GROUPE DE RECHERCHE EN GESTION DE PROJETS
ÉCOLE DE RELATIONS INDUSTRIELLES
UNIVERSITÉ DE MONTREAL

C.P. 6128 Succursale Centre-ville
Montréal (Québec) H3C 3J7
Telephone : 514-343-7707
Fax : 514-343-5764

Code Entr.: _____

No séquentiel: _____

Montreal, March 2002

École de Relations industrielles
Université de Montréal

École des Sciences de la gestion
Université du Québec a Montréal

Research Project on Success Factors in Project Management

Dear Respondent:

École de Relations industrielles de L'Université de Montréal, is conducting a research project on key factors influencing IT project success.

This study, polls the opinions and experience of practicing project managers in this field. We are convinced that results of this research project will prove useful to these practitioners.

To help us conduct this project, we solicit your cooperation and ask you to fill out the enclosed questionnaire, a task that should take you no more than 20 minutes. Your response will, naturally, be treated as confidential. Preliminary results, summarized and anonymized, will be made available to participating organizations. Only global results of this survey will be published.

Please return the completed questionnaire using the enclosed reply envelope. We ask you to please return it within ten days of receiving it. Detailed instructions are provided on the next page.

Truly and gratefully yours,

Prof. BELOUT Adnane
Project Coordinator
École de Relations industrielles
Université de Montréal

Ms. Keren Dolan
Principal Researcher
École de Relations industrielles
Université de Montréal

INSTRUCTIONS

1. Selection of a project and Respondent's involvement in it

To complete this questionnaire, you must select a project (in accordance with the definition below), in which you have been involved as a project manager (or as the manager of a high-level work package if it was a major project). Based on the Project Management Institute's *Guide to the Project Management Body of Knowledge* (often known as PMIBoK), a project is defined herein as a temporary endeavour undertaken to create a unique product or service.

2. Status of chosen project and Respondent's memory of it

The project you refer to must now be complete. You must remember this project well enough to be able to answer specific questions on its history, its management, its success, etc., or have access to the relevant data.

3. Selection of a phase within the chosen project

You must answer the questions with respect to a particular phase in the project life cycle of your chosen project, that is: initiation, planning, execution, or closing, as defined below, again based on the PMIBoK:

- **Initiation:** the initiation phase of a project consists of specifying the customer's needs, identifying a project to respond to those needs, and defining its key parameters; verifying its feasibility, risks and critical assumptions are determined in this phase.

- **Planning:** the planning phase of a project consists of establishing a detailed operating plan for its execution: task definition and organization (work breakdown structure), task assignment, detailed scheduling, and budgeting. At this stage, the general organization for doing the work and the management control system are defined.

- **Execution:** the execution phase of a project consists of carrying out, according to the plan, the work necessary to obtain the product or output that is the objective of the project. The execution phase starts with the project kick-off and ends with the complete production of the project's output.

- **Closing:** the closing phase of a project consists of transferring the project's output to the customer or client and by the project termination (resource release and account closure). Often, this phase leads to a formal project post-evaluation, with report.

4. Project Stakeholders and project management approaches

Several questions refer to stakeholders in the project or approaches to its management; the names used in the questionnaire are based on the following definitions:

- **Sponsor**: the project sponsor is the person or organization that decides to undertake a project and provides the necessary resources (financial or otherwise) for its execution.
- **Performing organization**: the organization performing the project is the firm whose employees are most directly involved in carrying out the project work during execution.
- **Project manager**: the person responsible for managing the project.
- **Customer, client, or user**: the individuals or organizations that use or will use the project's outputs.
- **Contract Project:** In a contract project, the sponsor and performing organization are separate organizations and the performing organization executes the project under contract to the sponsor and against a fee.
- **In-house project:** In an in-house project, an administrative unit of an organization (acting as a performing organization) executes the project for another administrative unit (which acts as a sponsor) of the same organization; there may or may not be a transfer of corporate funds from one unit to the other.

5. Sections of the Questionnaire

This questionnaire is made up of four sections as follows:

1. *Respondent's data:* socio-economic characteristics of the respondent;
2. *Project descriptive data:* general data on the project that has been chosen by the respondent to be the object of the next two sections;
3. *Success Factors:* the longest part of the questionnaire. It deals in detail with the presence or absence of certain success factors in the chosen project;

4. *Overall project success:* general appreciation of the extent to which the chosen project was or should be considered a success.

6. Answering questions

In Sections 1 and 2 of the questionnaire, please answer each question by circling one of the given options or by writing in the relevant data about yourself or the project.

In Sections 3 and 4 of the questionnaire, you are being asked to express your agreement or disagreement with given statements, by referring to your chosen project and phase within that project: please circle, in the space provided, the number, from 1 (strong disagreement) to 7 (strong agreement), that best corresponds to your evaluation or understanding of the project situation, as you observed or know it.

All your answers will be treated confidentially.

If you have any comments and/or questions about the questionnaire or on the research project, they are most welcome. Please write them in the margin or at the end of the questionnaire.

THANK YOU KINDLY FOR YOUR COOPERATION!

SECTION 1: RESPONDENT'S DATA

The objective of this section is to collect some personal data on the respondent. This data will be used to refine the analyses and will be treated in full confidentiality.

1) Sex:

   a) Male

   b) Female

2) Age:

   a) 18 to 24

   b) 25 to 34

   c) 35 to 44

   e) 55 and over

3) How long have you been working for this organization?

   Years: _____

   Months: _____

4) What is your highest completed level of formal education?

   a) College

   b) University (bachelor's level)

   c) University (Master's level or higher)

   d) Other

SECTION 2: PROJECT DESCRIPTIVE DATA

The goal of the present section is to collect general information about the project that the respondent has chosen to be the object of Sections 3 and 4 in this questionnaire.

Please provide the following information on this project:

1) Name of the chosen project: _____

2) Date project started: _____

3) Date project finished: _____

Please circle the statement that corresponds to your situation:

4) Indicate below, by referring to the definitions given on page 3, which specific phase of the life cycle of your chosen project will be the object of Sections 3 and 4 of the questionnaire:

   a) Initiation

   b) Planning

   c) Execution

   d) Closing

5) In which business area was your chosen project conducted?

   a) Information technology

   b) Engineering

   c) Construction

   d) Technology development (product or process development)

   e) Organizational project (restructuring, for instance)

   f) Social or humanitarian project

   g) Other, please specify:

6) Is this project, by reference to the definitions given in point 4, page 4,

   a) A *contract project,* executed by your organization under contract to a sponsor which is your firm's client?

   b) An *in-house project,* executed by your administrative unit for another unit of your organization?

   c) *Another type* of project, please specify:

   _____

7) In which cost range was your project?

   a) Less than $ 50 000

   b) Between $ 50 000 and $400 000

   c) Between $ 400 000 and $ 1 500 000

   d) Over $ 1 500 000.

8) Was the chosen project executed mainly:

   a) In Québec

   b) Elsewhere in Canada

   c) Outside Canada.

9) Based on your observations, in what type of organizational structure did the project team operate?

Circle below which of the three structure types applied, based on the definitions given below, which also are based on the PMIBoK.

   a) **Functional organization**: the organization responsible for executing the project performs a variety of activities, including projects; it is subdivided conventionally into functional areas named departments or divisions; only one of these departments is charged with the project; the project manager and project staff, who work mainly part-time on the

project, are all members of this department; coordination takes place between department or divisional managers.

b) **Projectized organization**: the organization responsible for executing the project performs mainly projects and few if any other activities; it is subdivided in a way that reflects its project focus and current situation; the project manager and project staff, who work mainly full-time on the project, are all members of a project group; coordination takes place within that group; there may even be a project office charged with providing technical and administrative assistance to the project managers

c) **Matrix organization**: the organization responsible for executing the project performs both projects and other on-going activities; it is subdivided in a way that reflects this double focus, with departments or divisions and project groups.

If you have circled the matrix organization, please specify the sub-type, based on the definitions below that best corresponds to your project:

C1) **Strong (Project) matrix organization:** a matrix organization that resembles a projectized organization, with mainly full-time project manager and staff;

C2) **Weak (Functional) matrix organization:** a matrix organization that resembles a functional organization, with part-time project manager and staff, the project manager having limited authority and involvement;

C3) **Balanced matrix organization:** a matrix organization that appears approximately half-way between the projectized and the functional organizations: project responsibilities and decisions are distributed in a balanced manner between project managers and line (functional) managers.

Section 3: Success Factors

First success Factor: Project Mission

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

Express your degree of agreement with the following statements.

Project Mission	**Your degree of Dis……agreement**
1) Project objectives (delivery of a quality product, schedule and budget adherence) were clear to me.	0 1 2 3 4 5 6 7
2) Reaching the objectives of this project was beneficial to the organization that decided to undertake it.	0 1 2 3 4 5 6 7
3) I was personally aware of the positive impacts of the success of this project on the organization that decided to undertake it.	0 1 2 3 4 5 6 7
4) The project objectives were shared by my colleagues.	0 1 2 3 4 5 6 7
5) The project objectives were shared by the top management of the organization that had decided to undertake it.	0 1 2 3 4 5 6 7
6) All managers and organizations involved in the project perceived the same benefits to result from the project's success.	0 1 2 3 4 5 6 7
7) During execution, I was confident as to the project's success.	0 1 2 3 4 5 6 7
8) The project objectives were not contradictory; they all appeared feasible.	0 1 2 3 4 5 6 7
9) The project objectives were explained to all staff concerned.	0 1 2 3 4 5 6 7
10) The objectives of this project converged with the organization's objectives.	0 1 2 3 4 5 6 7

Second Success Factor: Top Management Support

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

Express your degree of agreement with the following statements.

Top Management Support	**Your degree of Dis.....agreement**
1) Top management was aware of the quantity of resources (money, time, personnel, equipment) necessary for this project to succeed	0 1 2 3 4 5 6 7
2) Top management regularly received information on the project's progress.	0 1 2 3 4 5 6 7
3) Top management had notified in writing the project team of its support.	0 1 2 3 4 5 6 7
4) I was in agreement with top management as to my levels of authority and responsibility in this project.	0 1 2 3 4 5 6 7
5) Top management supported me in crises.	0 1 2 3 4 5 6 7
6) Top management had given me the necessary authority and did support my project-related decisions.	0 1 2 3 4 5 6 7
7) Top management was supportive of my requests for additional resources.	0 1 2 3 4 5 6 7
8) Top management endorsed the responsibility for meeting project objectives and achieving project success.	0 1 2 3 4 5 6 7
9) Top management showed its confidence in me.	0 1 2 3 4 5 6 7
10) Top management was aware of the impacts of inefficient management of this project.	0 1 2 3 4 5 6 7

Third Success Factor: Project Planning and Scheduling

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**

To express your degree of agreement with the following statements.

Project Planning and Scheduling	**Your degree of Dis.....agreement**	
1) A detailed plan including schedule, work packages, resource requirements, etc., was available.	0	1 2 3 4 5 6 7
2) The project team knew which tasks had slack that could be used on other work packages in case of emergency.	0	1 2 3 4 5 6 7
3) The project team had identified the skills necessary to successfully complete the project.	0	1 2 3 4 5 6 7
4) A system for satisfactorily measuring project schedule and budget performance was available.	0	1 2 3 4 5 6 7
5) An information system that produced periodic reports on the chosen performance measures was available	0	1 2 3 4 5 6 7
6) The project team was governed by rules of authority and a clear roles-and responsibilities matrix.	0	1 2 3 4 5 6 7
7) A detailed project budget was established.	0	1 2 3 4 5 6 7
8) Requirements for human resources were spelled out in the project planning.	0	1 2 3 4 5 6 7

Fourth Success Factor: Client Needs

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Client Needs	Your degree of Dis.....agreement
1) The client's needs were understood.	0 1 2 3 4 5 6 7
2) The project team discussed this project's relevance and contribution with the client.	0 1 2 3 4 5 6 7
3) The project was designed to respond to the client's needs.	0 1 2 3 4 5 6 7
4) The project team discussed the project limitations with the client.	0 1 2 3 4 5 6 7
5) The project team asked the client to specify his expectations and to formulate suggestions on the project	0 1 2 3 4 5 6 7

Fifth Success Factor: Personnel

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Personnel	**Your degree of Dis……agreement**
1) Manpower need forecast activities and internal staff movements (promotions, leaves) were performed so as to contribute to project success.	0 1 2 3 4 5 6 7
2) At the very project start, an analysis of project team training needs was performed. When offered, training proved adequate and sufficient.	0 1 2 3 4 5 6 7
3) Compensation policy and procedures, as well as employee C relations, were beneficial to project success.	0 1 2 3 4 5 6 7
4) Project team members were informed and helped to perform their work.	0 1 2 3 4 5 6 7
5) Within the project, labor laws and standards were respected.	0 1 2 3 4 5 6 7
6) Managerial efforts were made to maintain good relations with labor unions.	0 1 2 3 4 5 6 7
7) Disciplinary procedures and policy application were managed adequately and equitably within this project.	0 1 2 3 4 5 6 7
8) The description of tasks assigned to each project team member was clear and understood by each.	0 1 2 3 4 5 6 7
9) The degree of commitment to the project and its objectives was high.	0 1 2 3 4 5 6 7

Sixth Success Factor: Project Tasks

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Project Tasks	Your degree of Dis.....agreement
1) Technical resources available for the project were adequate.	0 1 2 3 4 5 6 7
2) Outside consultants and managers were called in to criticize key plans and overall approach.	0 1 2 3 4 5 6 7
3) Alternative plans and approaches for the project had been designed.	0 1 2 3 4 5 6 7
4) Project success depended on periodic adjustment and careful monitoring.	0 1 2 3 4 5 6 7
5) Technical means used for this project performed well.	0 1 2 3 4 5 6 7
6) The project team were up to the requirements of their work.	0 1 2 3 4 5 6 7
7) The project was understood by those who executed it.	0 1 2 3 4 5 6 7
8) Tasks were well performed.	0 1 2 3 4 5 6 7
9) The project team understood how this project could be integrated with other on-going projects.	0 1 2 3 4 5 6 7
10) Tasks to be performed were well understood by the staff.	0 1 2 3 4 5 6 7

Seventh Success Factor: Client Communication

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Client Communication	Your degree of Dis.....agreement
1) Potential users were contacted regarding the usefulness of project outputs.	0 1 2 3 4 5 6 7
2) An adequate presentation of project outputs was developed for I potential users.	0 1 2 3 4 5 6 7
3) This presentation was presented to selected potential users.	0 1 2 3 4 5 6 7
4) Adequate documentation on the project (instructions, work progress, use of project outputs, etc.) was periodically addressed to clients.	0 1 2 3 4 5 6 7
5) The client knew whom to contact when questions or problems arose.	0 1 2 3 4 5 6 7
6) The project team was organized so that client problems could be rapidly taken up for corrective action.	0 1 2 3 4 5 6 7
7) The client was informed of specific implementation problems that could impact on project outputs.	0 1 2 3 4 5 6 7
8) The project team coordinated its activities with other departments so as to respond to client requests.	0 1 2 3 4 5 6 7
9) Project clients and users were identified.	0 1 2 3 4 5 6 7
10) A significant effort was made to determine the best method for selling the project to clients and users.	0 1 2 3 4 5 6 7
11) The client was informed of project progress.	0 1 2 3 4 5 6 7

Eighth Success Factor: Control and Feedback

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Control and Feedback	**Your degree of Dis……agreement**
1) Actual project progress was regularly compared with plans.	0 1 2 3 4 5 6 7
2) If the project status showed impacts on the budget and/or schedule, these results were shared with the project team.	0 1 2 3 4 5 6 7
3) When the schedule or budget needed to be revised, the project manager asked for information from the project team	0 1 2 3 4 5 6 7
4) When the budget or schedule was revised, the changes and reasons for the changes were communicated to the project team.	0 1 2 3 4 5 6 7
5) When the budget or schedule was revised, the changes and reasons for the changes were communicated to top management	0 1 2 3 4 5 6 7
6) All project team members knew whether the project manager was satisfied with their work.	0 1 2 3 4 5 6 7
7) The project manager controlled all important aspects of the project, including the measures that provided a complete picture of project progress.	0 1 2 3 4 5 6 7
8) When the budget or schedule was revised, the changes and reasons for the changes were communicated to clients.	0 1 2 3 4 5 6 7
9) Regular meetings were held to control project progress and improve feedback to project team members.	0 1 2 3 4 5 6 7
10) Project team members were informed of the project progress status.	0 1 2 3 4 5 6 7

Ninth Success Factor: Problem Identification

Use this scale

Not relevant to the project or phase	Strongly disagree	Disagree	Weakly Disagree	Neither agree nor disagree	Weakly agree	Agree	Strongly agree
0	1	2	3	4	5	6	7

To express your degree of agreement with the following statements.

Problem Identification	**Your degree of Dis.....agreement**	
1) The project team was aware of the difficulties associated with the project.	0	1 2 3 4 5 6 7
2) The project analyzed these difficulties by discussing them with I the appropriate persons and by defining a problem solving strategy.	0	1 2 3 4 5 6 7
3) The project manager monitored the application of the problem solving strategies defined to counter project risks.	0	1 2 3 4 5 6 7
4) The project manager took immediate action when problems were brought to his/her attention.	0	1 2 3 4 5 6 7
5) In case of project difficulties, the project manager knew exactly where to go to obtain assistance.	0	1 2 3 4 5 6 7
6) Brainstorming sessions were conducted to predict where difficulties were most likely to originate from.	0	1 2 3 4 5 6 7
7) Project team members felt at ease to discuss problems with me.	0	1 2 3 4 5 6 7
8) Project team members were encouraged to rapidly take action to solve problems.	0	1 2 3 4 5 6 7
9) The project manager was confident that problems that arose could be rapidly and completely resolved.	0	1 2 3 4 5 6 7
10) The project manager did not hesitate to call for help form persons not involved in the project, if the problems warranted it.	0	1 2 3 4 5 6 7

Section 4: Overall Project Success

Please circle the selection that bests corresponds to your chosen project. Each answer must be related to the chosen life cycle phase, If the question has no relationship to your chosen phase, please circle 0.

Use this scale

Not relevant to the project or phase 0	Strongly disagree 1	Disagree 2	Weakly Disagree 3	Neither agree nor disagree 4	Weakly agree 5	Agree 6	Strongly agree 7

To express your degree of agreement with the following statements.

Overall Project Success	**Your degree of Dis.....agreement**
1) Technical requirements specified at the beginning oft. execution phase were met.	0 1 2 3 4 5 6 7
2) Project schedules were adhered to.	0 1 2 3 4 5 6 7
3) Project cost objectives were not met.	0 1 2 3 4 5 6 7
4) Project clients and/or product users were satisfied with project outputs.	0 1 2 3 4 5 6 7
5) The project has not perturbed the culture or values of I organization that managed it.	0 1 2 3 4 5 6 7
6) The project was not managed so as to satisfy the interests a challenges of the members of the project team.	0 1 2 3 4 5 6 7
7) There were no quality problems related to project outputs.	0 1 2 3 4 5 6 7
8) Technical problems were successfully identified and resolved	0 1 2 3 4 5 6 7
9) The project output could easily be manufactured a marketed.	0 1 2 3 4 5 6 7

Again, thank you very kindly for your cooperation!

Annex 2 - Frequency distribution histogram for the dependent variable

IT Project Success: