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Factors influencing project success: the impact of human resource management

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Abstract

Today, human resource management (HRM) is being renewed in organizations and gradually affirming its strategic role. However, the results of an empirical study conducted by Pinto and Prescott [Journal of Management 14 (1988) 5] within a context of project management, contradict this trend. These authors concluded that the "Personnel factor" was the only factor in their research that was marginal for project success. This paper attempts to retest their conclusions in rethinking issues of validity of the measures used in their study. In line with research by Tsui [Human Resource Management 26 (1987) 35; Administrative Science Quarterly 35 (1990) 458] and some of Belout's recommendation [International Journal of Project Management 16(1) (1998) 21], the construct validity of the human resources factor has been examined and a model proposed. Results show, first of all, that although there was a link between project success and the Personnel factor (based on the correlation analyses), this factor did not have a significant impact on project success. Our results tend also to confirm that the relationships between the independent variables and project success will vary according to life cycle stage. The results also show that for three distinct structures (functional, project-based and matrix), the Management Support and Trouble-shooting variables were significantly correlated with success. Finally, this study confirm a moderating effect between the independent variables and project success, depending on the sector studied. All in all, this research adds another step in conceptualizing HRM in project context which is still very rudimental. In this sense, researchers should, in the future, improve the construct validity of the Personnel variable by improving the psychometric properties of the questionnaires used in the project management context. This study also shows the problem of multicolinearity, which appears to be excessive in the use of PIP. Finally, a fundamental question is posed: does HRM in the context of project management have specific characteristics that make its role, social responsibility and operation different from the so-called traditional HRM?
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Nowadays, project management has become a key activity in most modern organisations. Projects usually have a wide variety of objectives, involve numerous internal and external actors, and are conducted in various activity sectors. Since 1980, many academics and practitioners have agreed that human resource management (HRM) is one of the most crucial elements of an organisation's success [1,2]. Today, HRM is being renewed in organisations and gradually affirming its strategic role. However, the results of an empirical study by Pinto and Prescott [3] contradict this trend. In a field study designed to test changes in the importance of ten critical success factors across four stages of the project life cycle, the authors concluded that the "personnel" factor is only a marginal variable in project success. These rather unexpected results were criticised extensively by Belout [4] who suggested that future research needs to retest Pinto and Prescott's conclusions and address fundamental questions: (1) Is personnel a significant factor in project management success? (2) In the model used, is the relationship between the independent variables and project success affected by the four project life cycle stages? and (3) Do organisational structures and project activity sectors have a moderating effect on the relationship between critical success factors and project success?

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These questions motivated the present research. More specifically, our objectives were twofold: first, we wanted to address the lack of empirical data available on critical success factors, including the personnel factor, by re-testing, in a field study, the theoretical model used by Pinto and Prescott and developed by Slevin and Pinto [5]. This objective is in line with the findings of a literature review on project management which revealed that most models explaining project success are based on theory rather than on empirical proof and that few academic studies have concentrated on the critical factors affecting project success [6]. A second objective was to further investigate the impact of the life cycle stage, type and structure of a project on the relationship between the critical factors and project success (dependent variable).

1. Theoretical background

Projects usually involve attention to a variety of human, budgetary and technical variables. Although many definitions exist, most researchers agree that projects generally possess the following characteristics: limited budget, schedule, quality standards, and a series of complex and interrelated activities (generally project-based or matrix structure). With respect to project success, historically, projects have been managed as technical systems instead of behavioural systems. That is, there has been a tendency to use a mechanistic approach focused on results with the main objective of attaining target dates, achieving financial plans and controlling the quality of the final product [7].

In regard to critical success factors, numerous lists and models have been proposed in the literature [6]. For instance, one article suggested that the following four dimensions should be considered when determining project success: project efficiency, impact on the customer, direct and business success, and preparing for the future [8]. The perception of the various interest groups (e.g. stakeholders, management, customers, and employees) is also regarded as a key factor since different people will view success in different ways [9,10]. Morley [11] noted that the project management triangle based on schedule, cost and technical performance is the most useful in determining the success or failure of a project [12,13]. To these standards, we added the notion of the project's risk and the capacity to resolve problems encountered by the project team (management uncertainty), which appear to be major elements in the evaluation of a project's success. Couillard [14] classified these risks into three groups, that is, risks linked to technical performance, those linked to the budget and those linked to schedule.

To date, the most important empirical studies on the critical factors in project success have been conducted by Pinto with coauthors Slevin [15], Prescott [3], Covin [16], and Mantel [10]. In 1987, Pinto and Slevin [15] developed a project model and identified 10 factors (Table 1). Their principal research question was: "Are project implementation critical success factors of equal and stable importance over the life of a project, or does their relative importance (weighting) change as the project moves through different stages of completion?" (p. 6). Regression analysis revealed that different factors were significantly related to project success in the four different stages. For instance, in the conceptual stage, project mission and client consultation were the two variables significantly linked to project success while in the termination stage, technical tasks, project mission, and client consultation explained 60% of the variance in project success. Surprisingly, the personnel factor "was the only factor not found to be significantly predictive of project success in at least one of the life cycle stages" (p. 13).

This latter finding contradicts a large body of organisational literature that suggests that organisational success can never be reached without qualified and motivated personnel [1]. In today's highly competitive environment, managing people effectively can also have a significant impact on the results of a project since, as Hubbard [17] noted, most major project failures are related to social issues. For instance, a study by Todryk [18] revealed that a well-trained project manager is a key factor linked with project success because as a team builder, he/she can create an effective team. This view is supported by other studies on project-team training [19,20].

2. A conceptual framework

Our model, which draws on Pinto and Prescott's [3] research, included 10 independent variables and three moderating variables (project life cycle, project organisational structure and project activity sector (Fig. 1). In reference to the importance of human resources in the organisations [2], we wanted to retest the impact of Pinto and Prescott's [3] 10 independent variables on the dependent variable of our model (Fig. 1). **Our general proposition (H1) was:** The Personnel factor will have a significant impact on the project's success.

The effect of life cycle stages on organisational effectiveness has long been recognised [21]. In project management, this concept has been investigated by numerous academics [22,23]. Each project cycle implies a different intensity of effort as well as different tasks and actors. Four stages are often identified: conceptualisation, planning, execution and completion). In line with Pinto and Prescott's [3] research suggesting that the effect of the critical factors on success varies as the project cycle stages change, we tested the effect of

Table 1
Pinto and Prescott's ten success factors [3]

Project mission	Initial clarity of objectives and general directions
Project Schedule	A detailed specification of the individual action steps required for project implementation
Client Consultation	Communication and consultation listening to all parties involved
Technical Tasks	Availability of the required technology and expertise to accomplish the specific technical action steps
Client Acceptance	The act of "selling" the final projects to their ultimate intended users
Monitoring and feed back	Timely provision of comprehensive control information at each stage in the implementation process
Communication	The provision of an appropriate network and necessary data to all key actors
Trouble-shooting	Ability to handle unexpected crises and deviations from plan
Management Support	Willingness of top management to provide the necessary resources and authority/power for project success
Personnel (recruitment, selection and training)	Recruitment, selection and training of the necessary personnel for the team

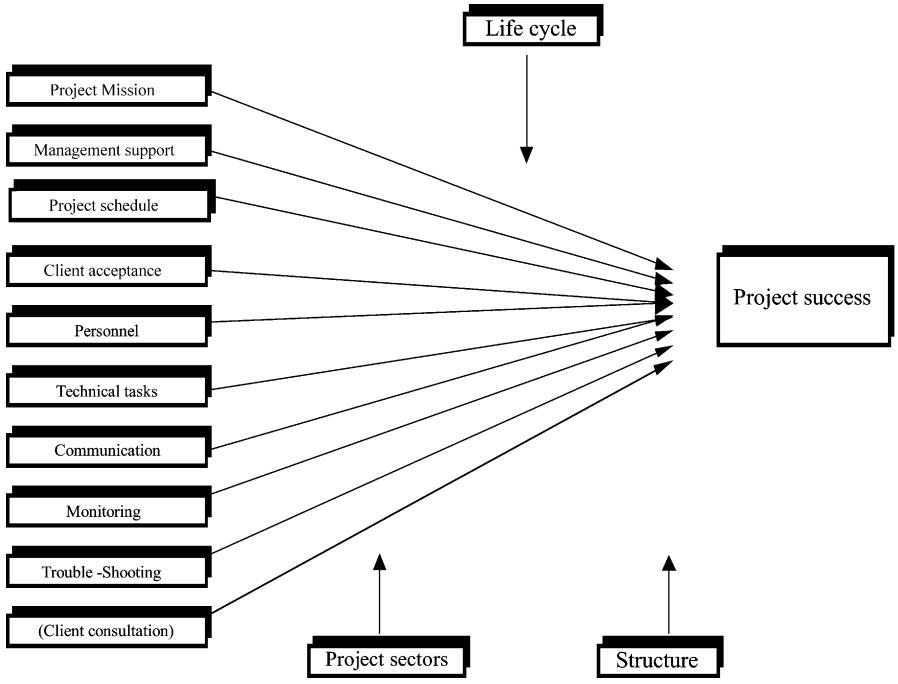

Fig. 1. The proposed model.

that variable on project success. **Our proposition (H2) was therefore:** the relationship between the independent variables and project success in the model will be affected by the four project life cycle stages.

In addition to the success factors proposed by Pinto and Prescott [3], we decided to investigate the impact of two other variables, that is, project structure and project activity sector, which we believe can affect the relationship between the critical factors identified above and project success. In fact, some authors have emphasised the importance of examining the impacts of organisational structures on effectiveness [24]. Applied to project management, one of the most interesting studies was carried out by Gobeli and Larson [13] who pointed out that each organisational structure in the project management context has its strengths and weakness. According to them, the type of structure chosen will significantly affect the success of the project. Their aim was to assess the relative effectiveness of five structures: functional, functional matrix, balanced matrix, project matrix and project team. They found that the project matrix and the project team structures were rated as the most effective. These structures affect the project manager's roles [22,25], the co-ordination of activities and the intensity of conflicts [26], thereby indirectly amplifying or reducing the project's effectiveness. **Our proposition (H3) was therefore:** Project structure has a moderating effect on the relationship between the independent variables and project success.

In this research, we also wanted to take into consideration the impact of the project's activity sector (business area or industrial sectors where the project has been conducted), which has been identified in the literature as being a major factor of project success. In 1996, Belassi and Tukel [6] suggested that in addition to management control, there are many factors that can

determine the success or failure of a project. They noted that most of the lists of evaluation criteria included factors related to project management and to the organisation but seemed to ignore the characteristics of the project and team members as well as factors that are external to the project. It should be noted that Pinto and Slevin [3] acknowledged that these factors were not considered in their studies. The impact of the environment on the success of projects is, however, a very important limitation and, as a matter of fact, they suggested that there is a distinction between projects that fail because of external factors and ones that fail because of management mistakes. Pinto and Covin [16] also confirmed that the activity sector of projects influences the importance of different success factors in the life cycle of projects. **Thus, proposition (H4) was:** Project activity sectors will have a moderating effect on the relationship between the independent variables and project success.

3. Methodology

In this study, the measurement instrument used was an adapted version of Pinto and Prescott's [3] Project Implementation Profile (PIP). A pre-test was carried out with 15 project management experts in more than ten Canadian organisations. This exercise allowed us to validate this instrument in the Canadian context and to make a few modifications on the basis of Belout's [4] critique as well as comments made by Pinto and Prescott [3] regarding multicolinearity and the Personnel factor. In addition, some questions under the 10 success factors were deleted. Two success factors, Client Consultation and Communication, were merged into one factor, Communication with the Client. In addition, we noted that Pinto and Prescott [3] deleted the Communication factor as defined in their questionnaire. The adapted PIP represents only nine factors of success instead of 10. Finally, the construct of the Personnel factor was revised completely in the light of Belout's critique [4]. Drawing on the eight dimensions proposed by Tsui [27], the Personnel factor construct was completed by questions on project commitment and clarity of the job description. Most of Tsui's dimensions [27] (such as legal obligation, negotiation with unions, administration of work contracts, administration services, etc.) were deleted based on the experts' recommendations following the pre-test. In the two first sections of the questionnaire, the respondents specified their socio-demographic characteristics and then identified a project that they had carried out to completion. They had to choose one of four stages of the project's life cycle—conception, planning, execution or completion—and answer all the questions in respect of that particular stage. The respondents were also asked to identify one of six activity sectors as well as one of three organisational structures (functional, project-based or matrix). The respondents had descriptions of these structural types and were asked to select the type that best matches with their organization.

The independent variables and the dependent variable were assessed in the third and the fourth sections of the questionnaire, which was divided into 10 subsections, each focusing on one of the 10 success factors finally identified. Each of the nine factors of success was made up of five to 11 indicators. For each factor, the participants had to rate their level of agreement for various statements on a seven-point Likert scale (from 1 strongly disagree to 7 strongly agree). For each question, it was also possible for the participants to choose "0," which meant that the question did not relate to the project situation the participant was evaluating. The dependent variable was measured through nine questions from the adapted PIP (Table 2). The candidates had to express their degree of agreement or disagreement with the statements on a similar seven-point scale (1 = strongly disagree and 7 = strongly agree).

To compare the different variables, we compiled the answers to the indicators for each of the dimensions, which gave us a score for each candidate for each variable. The stratified sample was not proportional. For the first stratum, project activity sector, the following project sectors were retained: information technology, engineering, construction, technological development, organisational development and so on. In each randomly-selected enterprise operating in project mode, the second stratification consisted of selecting a number of candidates for each of the four project stages (5, 10, or 20 questionnaires depending on the enterprise size). This stage was hard to control because the candidates did not know in advance which stage of their project they would retain. Finally, 212 questionnaires were distributed to project managers and 142 were returned, giving a response rate of 67%.

4. Results

The distribution of the respondents was as follows: 13% in the "conceptualisation" stage, 15% in the "planning" stage, 63% in the "execution" stage and, finally, 2% in the "completion" stage. As for the distribution by activity sector (Table 3), it can be seen that 27% of the projects examined were in the data processing sector, 17% were in engineering and 17% were in construction. Projects in the technological development and organisational sectors made up 10 and 6%, respectively, of our sample. The majority of our projects were "large scale" in that most of them had a value of over $400,000; 26% had a value of between $50,000 and $400,000 dollars, and only 4% had a value of under $50,000 dollars.

Table 2
Overall project success

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 the project outputs	0	1	2	3	4	5	6	7
(5) The project has not perturbed the culture or values of the organization that managed it	0	1	2	3	4	5	6	7
(6) The project was not managed so as to satisfy the interests and 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 and marketed	0	1	2	3	4	5	6	7

Table 3
Distribution of project sectors in the sample

Project sector	*N*	%
Information technology	38	27
Engineering	24	17
Construction	24	17
Technological development	14	10
Organisational development	8	6
Others	32	23
Missed values	2	–
Total	142	100

The organisational structure was also an important element since it corresponded to our second hypothesis. Project-based and matrix organisational structures made up 38 and 37% respectively of our sample and functional structures represented 22%. In the matrix structure, 55% of the projects were matrix type projects, 11% were functional matrix type and 34% were balanced matrix type. So as to ensure the homogeneity of each construct, we calculated the Cronbach's alpha coefficients. This measure of internal consistency is recommended for the analysis of an appreciation scale like the Likert [28]. In our study, the alpha coefficients were all over 0.70 and therefore acceptable (Table 4). The alphas for five of the independent variables were between 0.80 and 0.90.

Table 4
Homogeneity measure of the construct

Variable	Alpha	Number of cases
Project success	0.7280	65
Project mission	0.7669	115
Management Support	0.8476	99
Project Schedule	0.8543	111
Client Acceptance	0.8079	122
Personnel	0.7615	46
Technical tasks	0.7953	84
Communication	0.9093	80
Monitoring-control	0.8796	108
Trouble-shooting	0.8563	113

4.1. Hypothesis 1: effect of the Personnel factor on project success

To test the first hypothesis, we conducted a Pearson correlation analysis of the independent variables and the dependent variable, project success. As shown in Table 5 below, all independent variables were significantly related ($P <= 0.01$) with project success. There was a 0.377 ($P < 0.01$) correlation between the Personnel factor and project success, which confirms a link between these two variables.

Once we had established a correlation among the various independent variables and project success, we conducted a multiple regression analysis to evaluate the impact of each independent variable on the dependent variable. We first verified the degree of association between the independent variables. The Communication variable (5) showed the greatest colinearity, followed closely by Monitoring-Control, Trouble-shooting, Technical Tasks and Project Schedule, which each had a colinearity relation of 4 with the other variables. On the other hand, Monitoring-control had the highest coefficients. In this study, we removed the most highly correlated variables, such as Communication and Monitoring-control, from the analysis. It should be recalled that, after the Ridge regression, Pinto and Prescott [3] also removed the variables of communication and control (monitoring and feedback) from the regression analysis.

As shown in Table 6, the results from the multiple regression analysis indicated that both Management Support and Trouble-shooting were significant predictors of project success. We carried out this analysis for the two stages in which correlations exist (that is, the planning stage and the execution) and found that for the planning stage, Project Mission, Customer Acceptance and Management Support were significantly linked to the success of the project. For the execution stage, there was a significant relationship for Trouble-shooting and Customer Acceptance, with an *R*-squares of 0.34 and 0.39 respectively. It should be noted that, in the framework of this multiple regression analysis, the Personnel factor did not have an impact on the dependent variable

Table 5
Correlations between independent variables and project success

	Project success	Project mission	Management support	Project schedule	Client acceptance	Personnel	Technical tasks	Communication	Monitoring-control	Trouble shooting
Project success										
Project mission	0.530*** (90)									
Management Support	0.490*** (81)	0.696*** (90)								
Project Schedule	0.492*** (85)	0.279** (95)	0.319** (85)							
Client Acceptance	0.502*** (93)	0.503*** (107)	0.415*** (92)	0.575*** (100)						
Personnel	0.377** (62)	0.185 (69)	0.400** (68)	0.566***	0.470*** (71)					
Technical Tasks	0.473*** (65)	0.365** (74)	0.287** (71)	0.649*** (71)	0.670*** (78)	0.550*** (58)				
Communication	0.529*** (68)	0.463*** (76)	0.450*** (73)	0.759*** (70)	0.693*** (78)	0.564*** (56)	0.656*** (65)			
Monitoring-control	0.517*** (85)	0.369*** (100)	0.359** (84)	0.662*** (99)	0.574*** (98)	0.446*** (70)	0.674*** (73)	0.757*** (74)		
Trouble shooting	0.573*** (86)	0.332** (102)	0.260* (88)	0.605*** (98)	0.607*** (103)	0.409*** (69)	0.578*** (76)	0.644*** (74)	0.729*** (99)	

* $P<0.05$.
** $P<0.01$.
*** $P<0.001$.

of project success. Thus, we conclude that the hypothesis H1 was rejected.

4.2. Hypothesis 2: moderating effect of project life cycle

To verify this hypothesis, we conducted a correlation analysis between the independent and dependent variables (Table 7) under the control of different life cycles. We used the Spearman correlation, which is known for its use in distributions that are not completely normal [28]. This coefficient appeared to be the most appropriate because of the fact that we subdivided our sample according to different stages, considerably decreasing the number of cases and the probability of obtaining a normal representative distribution. In the conceptualisation stage, there were no significant relationships between the factors and the success measure. This may perhaps be explained by the low number of candidates for this stage. Thus, the correlation analysis was carried out on a number of cases varying from 5 to 11. In the planning stage, all the factors except Personal and Trouble-shooting were correlated with the success measure ($P<0.05$) with an "n" of 40–59. It should be noted that the "n" available for the execution stage was much higher than the other cases and therefore these results are more reliable. On the other hand, it was not possible to analyse the completion stage because there were only three candidates in the sample. Finally these results confirm that the relationship between the independent variables and project success will vary according to life cycle stage of projects.

4.3. Hypothesis 3: moderating effect of project structure

When we carried out a correlation analysis (Spearman) according to different types of organisational structure (Table 8), we found different results. Thus, for the matrix structure, there was a significant correlation between project success and the five independent variables of Project Mission, Management Support, Project Schedule, Monitoring-control and Trouble-shooting ($P<0.05$). It was not possible to do a more detailed analysis for the matrix structure because "n" was too small. When project organisational structure was used as a control variable, almost all of the variables appeared to be significantly correlated ($P<0.05$) with the exception of the Personnel variable. In the case of the functional structure, the five independent variables of Personnel, Management Support, Client Acceptance, Communication and Trouble-shooting were significantly correlated with success ($P<0.05$). So it seems that the independent variables have differing importance depending on the organisational structure. Therefore, we concluded that the Personnel variable was significantly correlated with success only in the case of functional structure.

Table 6
Success factors according to the regression analysis (*Stepwise* method)

Project stages	*N*	Variables	R^2	*F*	Significance	Constant
All stages	141	Trouble-shooting	0.21	390.22	<0.001	0.000
		Management Support	0.31	320.62	<0.001	0.065
Planning only	20	Project Mission	0.58	290.19	<0.001	0.000
		Client Acceptance	0.67	200.99	<0.001	0.000
		Management support	0.72	180.24	<0.001	0.000
Executing only	89	Trouble-shooting	0.34	470.33	<0.001	0.000
		Client Acceptance	0.39	290.55	<0.001	0.005

Table 7
Correlations among the various independent variables and project success categorized by project phase

	Project mission	Management Support	Project Schedule	Client Acceptance	Personnel	Technical Tasks	Communication	Monitoring-control	Trouble Shooting
Starting									
Project success	0.268	0.605	0.444	0.539	0.406	0.462	0.494	0.502	0.299
Planning									
Project success	0.553*	0.566*	0.514*	0.763***	−0.173	0.666**	0.624*	0.619**	0.480
Executing									
Project success	0.438***	0.401*	0.519***	0.598***	0.528***	0.355*	0.465**	0.510***	0.593***
Completion									
Project success	Not enough data to conduct analysis.								

* $P<0.05$.
** $P<0.01$.
*** $P<0.001$.

Table 8
Correlations among the various independent variables and project success categorised by project structure

	Project mission	Management Support	Project Schedule	Client Acceptance	Personnel	Technical Tasks	Communication	Monitoring-control	Trouble Shooting
Matrix									
Success	0.51***	0.42*	0.41*	0.31	0.32	0.31	0.21	0.53***	0.45**
Project									
Success	0.547***	0.480**	0.688***	0.704***	0.329	0.452*	0.613***	0.574***	0.632***
Functional									
Success	0.168	0.783***	0.353	0.504*	0.781	0.563	0.775*	0.314	0.606*

* $P<0.05$.
** $P<0.01$.
*** $P<0.001$.

4.4. Hypothesis 4: moderating effect of project activity sectors

Based on the data collected, we were able to carry out an analysis according to three main project sectors: information technology, construction, and engineering (the others had too small an "*n*"). The data analysis showed that all the variables except Client Acceptance were significantly correlated ($P<0.05$). For the engineering sector, only the variable of Project Mission and Client Acceptance seemed to be significantly linked to project success (Table 9). The same was true of construction, for which only Client Acceptance and Monitoring-control were significantly correlated ($P<.01$). We concluded that our results seem to confirm this hypothesis (see details on discussion section).

5. Discussion

The results of this study show, first of all, that although there was a link between project success and

Table 9
Correlations among the various independent variables and project success categorised by project sector

	Project mission	Management Support	Project Schedule	Client Acceptance	Personnel	Technical Tasks	Communication	Monitoring-control	Trouble-shooting
Information technology									
Success	0.416*	0.522**	0.504**	0.252	0.622**	0.470*	0.509**	0.518*	0.583***
Engineering									
Success	0.536**	0.296	0.219	0.468*	0.103	0.293	0.110	0.239	0.373
Construction									
Success	0.387	0.413	0.041	0.761*	0.393	0.577	0.775*	0.825***	0.525

* $P<0.05$.
** $P<0.01$.
*** $P<0.001$.

the Personnel factor (based on the correlation analyses), this factor did not have a significant impact on project success (H1 is rejected). In this sense, our results concur with those of Pinto and Prescott [3]. Thus, how do we explain that an administrative function which is described in the literature as fundamental to achieving success in organisations does not have an impact on project success? Does HRM in the context of project management have specific characteristics that make its role, social responsibility and operation different from so-called traditional HRM? Does the difficulty in measuring the impacts of HRM on organisational success (widely described in the HRM literature) explain this finding?

It is useful to recall that the measurement of the impact of personnel management on the effectiveness of organisations and projects is currently the subject of numerous studies [1,27]. Among scholars' general conclusions, it is reported that the lack of consensus on a common and coherent definition of effectiveness in HRM has fuelled an argument over the very definition of so-called effective personnel management. Thus, the problem that managers have in identifying the causes of a human activity's result has been brought out by several scholars. Moreover, the diffuse nature of HRM (a fragmented function within organisations, according to Ulrich [29], the vagueness of a number of HR objectives [30], the difficulty in interpreting the results of an HR practice [31], and the arbitrariness of evaluators make it very difficult to accurately measure the impact of HRM on organisational success. We believe that this problem is certainly magnified in the project management context due to the possible confusion between the various actors' roles (sometimes, in complex structures such as the matrix type), project-related risks, time constraints, and cost and quality constraints. Moreover, human resources are nowadays redefined in an increasingly strategic role [35] and their interventions tend to affect all levels of the organisation. It is thus difficult to establish a direct link between an HR department's actions and tangible results, in terms of their impact on a specific programme or project [33,34]. This is all the more true in the case of matrix-type or project-based structures.

Our results tend to confirm that the relationships between the independent variables and project success will vary according to life cycle stage. The correlation analyses showed that in the execution stage, all the variables were significantly correlated with success whereas in the planning stage, the Personnel and Trouble-shooting variables were not correlated with success. It seems surprising that the Personnel variable was not correlated with project success in the planning stage given that several HR practices (including human resources selection and planning, performance standards, etc.) are carried out at that stage of a project's life. In a project planning stage, project leaders and their teams concentrate on breaking down projects into work packets (structural planning, or Work Breakdown Structure) in order to allocate the resources (including human resources) to the project before executing it. This is an essential operation since the human resources planning for the entire project is developed at this stage through simulated auditing using appropriate software. In this theoretically crucial stage for carrying on with subsequent operations and thus for making the project a success, project managers allocate human resources by work packets and audit them (among other things) in order to avoid human resource surpluses or shortages during the project's execution (levelling out of resources). This type of personnel management, which is based on the Charter of Responsibilities in project management, is certainly recognised as a key to success in this activity sector. From this perspective, the results of our study give rise to questions about the importance of traditional HRM practices in a project-based context and the way they should be measured. Should we perhaps consider using specific indicators which are adapted to HR practices during the different stages of a project's life cycle?

However, our regression analyses confirmed the importance of considering the life cycle when analysing

the factors of a project's success (Table 6). The results show that it is important to define and communicate the project's mission clearly during the planning stage. Furthermore, it is also essential at this stage to fully grasp clients' needs and establish with them the project's limits and priorities (expected quality standards, schedules, risk acceptance, method of project management to be adopted, monitoring conditions, communication methods between the different actors, etc.). Similarly, top management support is also important. It is during this planning stage that feasibility studies are completed and budgets by work packets are distributed in order to finalise the project's total budget. Moreover, negotiations are conducted with the various external and internal actors, including top management, on the formation of the project team and the determination of work processes (autonomy of the project cell, degree of formalisation, centralisation of decisions, roles of project-linked units, project interfaces, etc.). Thus, it is understood that top management support is a necessary condition for carrying on with subsequent operations in terms of the operating means to be implemented. These results concur with those of Pinto and Prescott [3] who also identified three critical factors of project success in the planning stage, that is, mission, top management support, and client acceptance.

It was found that Client Acceptance was an explanatory factor of success in the planning and execution stages of the project. This result confirms the importance of management approaches in which the client is at the centre of the organisational dynamic [35]. The Trouble-shooting variable was identified as the second factor that explains project success in the execution stage. When problems occur while the project is being executed, it is important that the project team rapidly identify the source and extent of the trouble and solve it. This demonstrates that it is important, to a certain degree, to have an adapted and flexible workforce and environment which can react rapidly and effectively to the problems that arise. It should be noted that Pinto and Mantel [10] also identified, in a study on the factors in project failure, trouble-shooting as an important explanatory factor for project failure or success. Moreover, the fact that this variable appears to be an explanatory factor for success lends credibility to studies that focus on project-related risk factors. A more risky project will probably encounter more troubles and will require greater Trouble-Shooting ability than less risky projects. This ability to react is mainly based on the skills of the project team and manager. In this sense, Couillard's study [14], which focused on the most appropriate management approaches based on risk profile, maintained that when a project-related risk is high, the project's success is significantly influenced by the degree of authority of the project manager, communication, team co-operation, and trouble-shooting.

With regard to organisational structures (hypothesis 3), the results showed that for three structures, the Management Support and Trouble-shooting variables were significantly correlated with success. Thus, regardless of the type of organisational structure, top management support and problem identification were linked with project success. Moreover, Mission, Project Schedule and Monitoring-control appeared to be significantly correlated with success in the case of matrix-type and project-based organisational structures, whereas this was not true of the functional structure. This might demonstrate that it is important to have clear objectives (mission), good planning, and an effective monitoring system in less structured organisations where the project cannot be developed on the basis of a functional organisation with pre-determined procedures. Moreover, it is noted that in the case of the project-based structure, the Technical Tasks variable appeared to be significantly correlated with success whereas this was not true of the other two structures. This highlights the importance for projects that operate with an autonomous and separate team to concentrate on the tasks and technical means needed for completing the project. This seems to be logical if we consider that a project team, which operates within a project-based organisational structure and cannot entirely rely on other departments without risking delays or conflicts, must possess all the necessary technical elements and skills in order to complete the tasks required for the project's success. Only in the functional organisational structure did the Personnel variable show a significant correlation with project success. This could be explained by the fact that in the functional structure, there is usually a well-established human resources department, which is not necessarily the case in the other structures.

Our last hypothesis referred to the existence of a moderating effect between the independent variables and project success, depending on the activity sector. Our results seem to confirm this hypothesis. Why is it that in the information technology sector, all the variables except Client Acceptance were significantly correlated with project success? How do we explain that in the engineering sector, only two variables were significantly correlated with project success (i.e. Project Mission and Client Acceptance)? Moreover, in the construction sector, Client Acceptance, Communication and Monitoring-control were significantly correlated with success. On the whole, it was found that each project was unique and its primary characteristic was fundamentally linked with the immediate environment of projects. Thus, it is understandable that in a context of great uncertainty and ongoing competition, all projects will impose different challenges on their teams. A comparison of this result with those in Pinto and Covin's study [16] shows that in the execution stage (construction), client consultation is an important variable that

accounts for project success (unlike the research and development sector in this same study). We believe that more in-depth research should be conducted in order to understand why, in the information technology sector, client needs are not correlated with project success. We might find out that in certain activity sectors—such as information technology, and research and development—client needs are considered and expressed in a different way (found, for example, mainly at the beginning of the contract and based on more standardised norms).

6. Conclusion

Today, many researchers agree that the human resource function is one of the most crucial elements in an organisation's success [2]. HRM is clearly being renewed in organisations and gradually affirming its strategic role. In its official definition of the Project Management Body of Knowledge, the Project Management Institute included HRM as one of the six fundamental functions of project management. In spite of this trend, however, the findings of the present study, like those of Pinto and Prescott's [3] research, are surprising. The results show that the Personnel factor is only a marginal variable in project success. We have presented a conceptual scheme that better operationalizes the PIP instrument. In line with research by Tsui [27,33] and some of Belout's recommendation [4], the construct validity of the human resources factor has been examined. For reasons of feasibility, we did not apply all the methodological recommendations of Belout's study [4]. Thus, essentially project managers have evaluated the personnel factor. In this sense, the P.I.P. instrument does not evaluate the motivation, the training, the experience, the commitment of the project managers as independent variables. This could be an important limit and a weakness in this research because the project managers are considered as a crucial and central actors for success and effectiveness.

Despite the obvious effort at conceptual development and methodological improvements made to complete the present research, the results relating to the impact of HRM remain surprising. Research on HRM in the project management context is as yet undeveloped. Publications are relatively rare and most research simply involves case studies or expert reports. Future research should concentrate on overcoming some of the shortcomings of the PIP instrument and continuing to build the theoretical foundations related to this topic. Researchers should attempt to improve the construct of the Personnel variable by validating questionnaires in the project management context and correcting the problem of multicolinearity, which appears to be excessive in the use of PIP. Future studies should be aimed at redefining the HRM construct, taking into account the specificity of the project management context (constraints of cost, time and quality, risks, factors external to projects, etc.). It is recommended that future studies measure the impact of PIP factors (independent variables) while taking into account the combined effect of moderating factors on the project success variable. They should also measure project success from three viewpoints : sponsor's view, project manager's view and sponsor as project manager's view [4,36].

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