Measuring the knowledge transfer for an educational program on Project Management

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ABSTRACT

This paper focuses on the analysis of the impacts of project management corporate training programs. This work aims at providing evidence regarding the impact of project management training programs by analyzing three layers at which training can be evaluated: i) perceived quality, ii) knowledge and iii) applied competences. Data has been collected within a corporate training program on project management within an international industrial group involving more than 500 project managers. Empirical analyses are based on customer satisfaction questionnaires fulfilled by the participants to the training activities, knowledge tests that participants had to undertake before and after the training program, and a survey conducted one year after the training activities. The analysis of the relationships among the different variables provides evidence of the conditions that influence the transfer of project management training into specific behaviors. These results also highlight guidelines that companies should consider in order to design effective training programs.

INTRODUCTION

Organizations are increasingly spending on professional development through corporate development programs targeted on specific communities or professional families. According to the 2010 ASTD State of the Industry report, U.S. organizations spent $125.88 billion on employee learning and development in 2009[‡]. How to measure the impact of such initiatives in order to justify training investments still represents an open debate (Preskill, 1997; Lien et al, 2007; Hashim, 2001). The importance of evaluating the training activity in an objective and quantitative way is continually stressed in the training literature (Bober & Bartlett, 2004; Noe, 2000; Swanson & Holton, 1999). Still, training evaluation is very difficult and a single best practice has not been identified yet (McLean, 2005).

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‡ http://www.astd.org/content/research/stateOfIndustry.htm

Different models have been proposed along the time (Swanson, Holton, 1999; Garvin, 1995), but the one that is still more known, used (and criticized) is the Kirkpatrick's hierarchical model (Kirkpatrick, 1976, 1994).
The model encompasses 4 different levels, each investigating different issues of a training/development program (see Figure 1):

- **Level 1: Reaction.** To what degree participants react favorably to the training. This level measures how participants in a training program react to the training. Every program should at least be evaluated at this level to answer questions regarding the learners' perceptions and improve training. This level gains knowledge about whether the participants liked the training and if it was relevant to their work.

- **Level 2: Learning.** To what degree participants acquire the intended knowledge, skills, attitudes, confidence, and commitment based on their participation in a training event. Level 2 evaluations are conducted before training (pre-test) and after training (post-test) to assess the amount of learning that has occurred due to a training program.

- **Level 3: Behavior.** To what degree participants apply what they learned during training when they are back on the job. Evaluations at this level attempt to answer the question of whether the training has been transferred back to the job. This evaluation should be performed at least three to six months after training.

- **Level 4: Results.** To what degree targeted outcomes occur as a result of the training event and subsequent reinforcement. This evaluation measures the success of the training program in term that executives and managers can understand such as increased production, increased sales, decreased costs, improved quality etc.

Figure 1: Kirkpatrick's (1994) 4 levels hierarchical model

Many critics have been moved against the causal hierarchical mode (Bates, 2004), the main are listed below:

<u>Causal Linkage Assumption</u>
The first critic is about the assumption of causal relations between the levels of evaluation. Various empirical analyses (Alliger & Janak, 1989; Alliger, Tannenbaum, Benett, Traver & Shotland, 1997) have highlighted a lack of correlation among the measures identified at different levels of the model. Moreover Bates (2004) points out that the causal linkage assumption may even drive to an over-reliance on reaction measures (level I) diverting trainers' attention away from efforts to make training truly effective to a focus on developing entertaining, amusing, and easy-going training that participants find enjoyable (Michalski & Cousins, 2000).

Environment Factors

The second main critic raised against the model concerns the very narrow set of variables considered. Even assuming an increment in learning, indeed, it is clear that environment factors may either support or inhibit the change of behaviors (application of learning on the job) (Holton et al., 2001; Mathieu et al., 1992). Several studies have established that the environment factors affect the linkage between level II and Level III (Huczynski and Lewis, 1980; Roullier and Goldstein, 1993; Tracey et al., 1995; Xiao, 1996; Cannon-Bowers, Salas, Tanenbaum & Mathieu, 1995; Ford and Kraiger, 1995; Salas & Cannon-Bowers, 2001; Tannenbaum & Yukl, 1992; Kontoghiorghes, 2001, Holton et al, 2000; Bates, Holton, Seyler & Carvalho, 2000) showing clearly that environment factors like the organization, the individual characteristics, the communication, the commitment of the management etc. can affect the transfer of learning into new behaviors.

Focus on higher levels

Assuming that level four is the most important and that impacting on it is the aim of every training activity can be wrong because of many reasons (Bates, 2004). First because most training efforts have little capacity to directly affect the company results. Many training activities are of short or modest duration (2-3 days) and are meant to have only a limited impact on the participants involved. Second the lack of impact on level IV could be given by the poor effectiveness of the training as well as by the design of the wrong training for achieving the results. In other words a perfect training delivered to wrong participants will lead to poor results (e.g. if participants are trained on practices not included in their roles), and focusing only on the economic measure would not allow to detect how to improve the effectiveness.

Economic Estimation

Finally, many contributions claimed the need to estimate the impact of training activities also in an economic way (Geber, 1995; Wang, 2003). Still, the usage of models based on indicators like Return on Investment is limited, mainly because it is hard to give a quantitative estimation of the costs and benefits of training activities (Allinger, Janack, 1989; McLinden, 2008; McLean, 2005). Starting from Phillips (2003) contribution, Alam et al. (2008) propose a model based on five different levels adding

Return on Investments as level five. But many authors underline that it is not possible to make measurements that enable ROI to be evaluated with respect to intangible benefits (Rowe, 1994)

In the following paragraphs the Kirkpatrick's hierarchical model will be applied to a real case taking into account the main critics above.

THE CASE OF A TRAINING PROGRAM ON PROJECT MANAGEMENT

This paper is focused at assessing the impact of GMG (Program on Project Management), a 3 years long training program on project management designed and delivered within the AERODEFENCE group. AERODEFENCE is a leading manufacturer in the high technology sector and ranks among the top ten global players in aerospace, defence and security. The group counts with something less than 100,000 employees in a total of 396 locations in 20 countries and covers different business including Aeronautics and Defence. Almost all the group activities are project based and the GMG programme was aimed at increasing the project

management performances across the group companies. The GMG program involved 2000+ participants, delivered 100.000+ hours of training over 221+ courses editions in 22 different training locations distributed in USA, UK, France, Italy and Asutralia.
The size, the investment and the purpose of the GMG allow to expect an economic return. Thus, the program evaluation was designed to fully apply the Kirkpatrick's hierarchical model. This implies on the one side to define metrics for each level and, on the other side, to test the causal relationships.
Following previous studies (Steensma & Groeneveld, 2010), Level I (Reactions) was measured through Customer Satisfaction questionnaires for each single course edition. Moreover the main courses of the program had an entrance test and a learning verification test to measure the learning effect (level II). Level III (behaviors) was measured through the frequency of application of observable practices (more details will be provided in the following). Finally, the group standards allowed to measure level IV (Results). Indeed, AERODEFENCE has been one of the pioneers in applying the EVA (Economic Value Added) methodology to measure the value created at the project level.
About the linkages among the different levels, the one between Reactions and Learning has already been investigated by many previous works (Noe and Schmitt, 1986; Dixon, 1990; Warr and Bunce, 1995; Morgan and Casper, 2000). On the other hand many studies showed that Project Management competences and behaviors are crucial for project success (Crawford, 2000; PMBOK® Guide, 2004; IPMA's Competence Baseline, 2006; APMBoK, 2000; Posner, 1987; Price, 1994; Crawford and Lynn, 1997). Thus, the present work will be focused on investigating the linkage between Level II (Learning) and Level III (behaviors).

MEASURING THE IMPACT OF A TRAINING PROGRAM AT LEVEL III: BEHAVIORS

In the attempt to apply the Kirkpatrick's model to real cases, recent studies (Steensma & Groeneveld, 2010) operationalized each level and measured their values before and after the training activity.
Besides that, with this research, we also want to demonstrate the actual correlation between changes in learning and behaviors: in other words, we want to test the causal effect. Thus the main purpose of the present article is:

> *To measure the impact of the GMG training program on the behaviors of the participants.*

The GMG programme was planned from the beginning leveraging the competence theory. Starting form the definition of competency given by Boyatzis (1982) as 'an underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation', Spencer and Spencer (1993) added that 'a characteristic is not a competency unless it predicts something meaningful in the real world'. The authors also proposed the idea of a dictionary of competences to define those characteristics that are crucial to the performance. The dominant view in managerial practice assumes that competencies are "universal" constructs whose meaning is independent from any specific context (McClelland, 1978; Spencer & Spencer, 1993). The "universalist" approach ensures a high degree of efficiency through standardization of competency codebooks. However, the effectiveness of this approach has often been questioned (Boyatzis 1998). Overgeneralization makes the description of competencies ambiguous and does not provide HR managers with adequate practical information. An alternative, "situationalist" approach (Sandberg, 2000) defines competencies as situated, idiosyncratic constructs whose meaning is deeply influenced by organizational culture and by the unique way people make sense of their jobs. Following this approach, the GMG Programme started by defining the roles involved in Project Management (6), the list of Competences (23) needed to manage projects in the best way in the specific environment. To do so, none official standard was fully applied but both the PMI Project Management Body of Knowledge (PMBoK) 2004) and the IPMA competence baseline (2006) have been integrated with specific competences crucial to the group (e.g. value management).

Competence	First level Description
Bidding	Ability to make a program technical contribution to the phases of bid preparing, managing and revising, interfacing with the company functional areas and with the specialists
Scope management	Ability to decompose the scope of work into manageable and verifiable components, using a structured model. Variants and their effect on time, cost, resources and quality are to be managed and deliverables are to be defined
Resource management	Ability to coordinate and manage the material and human resources assigned to a program/project, with a view to the optimization
Time management	Ability to develop scheduling techniques based on the activity duration estimation and to apply network analysis and time compression/reduction techniques
Cost management	Ability to interpret the economic data regarding the related WBS and guarantee the correct CBS processing
Performance control	Ability to measure a project performance and to identify variance causes (if any) and the appropriate corrective actions, also through the analysis of the related reporting and with the contribution of the specialists
Risk management	Ability to apply risk management techniques (i. e., risk assessment, analysis, management and monitoring), interfacing with the company functional areas and with the specialists
Value management	Ability to evaluate and interpret and governance the value creation logics

Table 1: Subset of competences targeted by the training and measured by the present study

Even if it is not the focus of this article, it is important to underline that the entire population (2000+ people) went through an assessment of the current level of competences and that the gap analysis drove the definition of the 13+ different courses included in the programme.

The present study is focused on a subset of participants and courses in order to reduce the noise in statistical analysis. More precisely, the roles selected for the study are

Project Managers and Assistant Project Managers and the courses they went through were covering only eight of the competences defined. (see Table 1).
In order to achieve the paper objective, we focused on each of the previous competences using the model in Figure 2 to investigate only a segment of the hierarchical model: the causal effect between level II (learning) and level III (behavior). The variables and the research propositions of the model are described below, while their operationalization will be included in the methodology session.

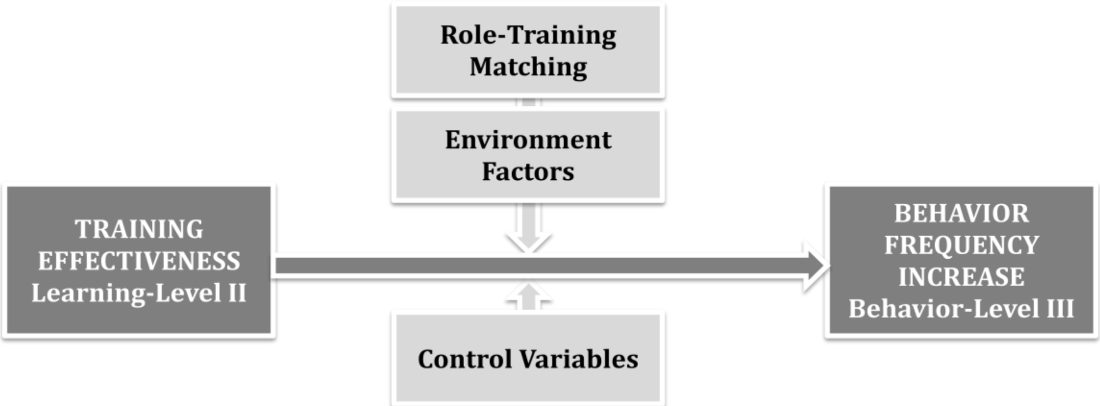

Figure 2: paper framework

Behavior frequency increase is the output variable of the model. It measures to what extent after the training, the trainees changed their behaviors and transferred into the day by day work what they learned during the training. According to Kirkpatrick's hierarchical model Training Effectiveness should have a causal relationship with the Behavior Frequency Increase. This allows us to draw the first research proposition.

> *RP1: training effectiveness has a positive impact on behavior frequency increase*

However, as previously mentioned this relationship may be influenced by environment factors. As Holton III et al. (2000) showed in their research, Environment Factors like managerial commitment, opportunity to use etc. might impact the relationship between the training effectiveness and the behavior frequency increase. For example they underline how the implementation of a new model of leadership presented during the training can be inhibited if the trainee's supervisor criticize his/her "new way of doing things".
Thus the second research proposition we want to test is:

> *RP2: interactions between training effectiveness and enhancing factors has a positive impact on behavior frequency increase*

Another critical factor impacting the hierarchical model is the correct target of the training activities. Training may not impact on the behavior because of a poor training as well as because of a wrong training (Bates, 2004). For example, if the trainees are not requested to be responsible for risk management, they will not increase the adoption of practices related to that competence even if they were exposed to an excellent training on risk management.
These data let us draw our third research proposition:

RP3: interactions between training effectiveness and role fitting has a positive impact on behavior frequency increase

METHODOLOGY

Sample and data gathering methodology

In order to test our research propositions data was collected among participants to the previously described training program.

First of all a subset of all participants to the training program was selected in order to have s more uniform sample. Specifically among the 2000 participants only Project Manager and Assistant Project managers were selected leading to a selection of 562 participants belonging to 20 different operating companies. They were submitted an online questionnaire composed by 150+ multiple-choice questions. The questionnaire was designed coherently with the previously mentioned competence model. Before the mass submission, the questionnaire was tested in 10 semi-structured interviews to validate the questions and to evaluate the discriminant capability of the questionnaire. In the end 449 compiled questionnaires provided sufficient data for the purpose of this work with an 80% response rate. More information about variables ad measures adopted in the questionnaire is provided below.

Measures

As the model highlights in figure 2, we need to define 5 variables. The survey instrument was designed in order to evaluate these dimensions over the 8 described competences, thus all variables will be defined at competence level. Principal Component analyses on collected data confirm that each group of variable tends to factor together based on the specific competence considered. In order to define proper constructs we adopted confirmatory factor analysis by means of Structural Equation Modeling. All models were controlled for proper fit by measuring NFI, CFI and RMSEA and checking that these fit index were acceptable (NFI>0.95, CFI>0.95, RMSEA <0.10) coherently with what previous contributions suggest (Marsh et al., 1988). Cronbach's alphas were also tested to verify the construct reliability: a limit to 0.70 was considered in order to accept the construct (Nunnally, 1994). In the following the specific measures adopted are described.

<u>Behavior Frequency Increase</u>

This variable represents the dependent variable of our model. It measures the actual change in the behaviors of the participants from before to after the training, along a 18-months time window (Steensma & Groeneveld, 2010). In order to define and measure the impact of the training activity on the results the "situationalist" approach to competences (Sandberg, 2000) was applied. For each of the eight competences**Error! Reference source not found.**, different observable behaviors have been defined. For example for the competence *Scope Management* an observable behavior was: "I formally write the Scope of the project and the objectives (Scope Statement) and I agree them with the functions involved, the top management and the project team". Every competence was "translated" into a number of behaviors ranging from 4 to 8, resulting in 43 observable behaviors. Every participant had to say for each practice if the level of adoption, before and after the training program, had improved. The answers were on a Likert 4 points scale ranging from *it didn't improved* to *it strongly improved*. These data have been used to measure the

dependent variables of the model§.
Confirmatory factor analysis provides evidence of good fit and acceptable reliability. Specifically 8 constructs were tested each referring to one competence.
For each competence a specific construct was defined by evaluating the average of the underlying practices.

Training Effectiveness
As suggested by Kirpatrick (1994), the effectiveness of the training activity was measured by asking to the participants for each behavior, how much the training activity contributed to understand the importance of the behavior and of its application. The answer was on a Likert 4 points scale ranging from *it didn't contribute* to *it strongly contributed*. These data have been used to measure the independent variable** of the model.
Coherently, based on the provided answers, we tested by means of a confirmatory factor analysis the reliability of the construct. Again 8 constructs were tested each referring to one competence. Confirmatory factor analysis was again applied providing good fit and acceptable reliability.
For each competence a specific construct was defined by evaluating the average of the underlying practices.

Environment Factors
One of the main critics against the hierarchical model is that it focuses on a too narrow set of variables not taking into account environmental factors. Holton III et al. (2000) identify 16 factors that may impact on the behavioral changes of the trainees. The first set of semi-structured interviews allowed to reduce the number of helping (inhibiting) factors from 16 to 5. More precisely they are:

- Management commitment
  The direct supervisors can heavily help/inhibit the application of specific behaviors
- IT Infrastructures
  Many PM practices leverage heavily on in/out flows of data. The presence or the lack of an adequate infrastructure (both software and hardware) can have a major impact on PM practices' adoption.
- Degree of collaboration of the functions involved
  Projects are by definition crossing many different functions and they rely on support processes not specifically designed for them (e.g. purchasing or manufacturing). In many cases the PM practices involves people in the functions that can be more or less willing to accept a change in their activities.
- Corporate requests
  This variable is specific of the case. Starting from the year 2000 the corporate introduced some directives on Project Management (e.g. Eearned Value, Risk, Planning…) asking the single companies to be compliant with them. In some Operating Companies (or on some specific projects) the pressure of the request has been higher during the last two years, resulting in a higher change in the PM behaviors.
- Customers Requests

§ Details on the statistical analyses will be provided in the following paragraphs
** idem

As it was said, the Operating Companies of the group compete in very different businesses and they may have very different customers, ranging from the military departments to single private companies or Public Administrations. These customers may have themselves different levels of maturity about project management. The most structured ones may help the impact on some behaviors, while the less mature may not recognize the value or even not understand the reports deriving by the adoption of advanced practices of project management.

All the previous factors have been investigated with the questionnaire for each competence (8) using a Likert 5 points symmetric scale ranging from *it strongly inhibited*, to *it didn't have any impact*, to *it strongly helped*. Confirmatory factor analysis and reliability testing were satisfactory and allowed us define 8 factors, one for each competence.
For each competence a specific construct was defined by evaluating the average of the underlying practices.

Role-Training Matching
One of the main objectives of the GMG programme was to uniform the role of the Project Manager. Companies were requested to be compliant with the role description provided by the corporate by adapting the existing role of Project Managers to the one described in the model. The whole training activity design was already compliant with the model. Thus, in this specific case, the missing matching between the actual role and training, must be seen as a not yet perfect fit between the actual role of PMs in the single company and the one described by the model.
The fitting of the role is investigated by asking to participants if in their organization they are requested to apply each (43) single practice (binary variables).
Similarly to previous constructs also these were acceptable and reliable.
For each competence a specific construct was defined by evaluating the average of the underlying practices. In appendix, table 7 provides descriptive statistics for all variables and their mutual correlations

Control variables
As previously mentioned, we considered 20 companies operating within AERODEFENCE group. Even if these companies refer to the same holding, they operate in different industrial sectors. Previous literature has highlighted that project management practices are applied differently in different industrial sectors, so we decided to control for this effect. Specifically companies were grouped in 5 main industrial sectors: Aeronautics, Defense, OTHER 1, OTHER 2, OTHER 3, OTHER 4.
We also considered the number of years of experience of the participants in their role. This variable was aimed at considering that different participants may react differently to a training program also due to their specific experience.
Table 2 provides descriptive statistics concerning the number of participants belonging to each industry and the years of experience.

Ind. Sector	%
Aeronautics	37,2
Defense	6,2
OTHER 1	5,3
OTHER 2	16,7
OTHER 3	31,8
OTHER 4	2,7
Total	100,0

	Mean	Median	Std. Deviation
Years of experience	4,52	3,00	5,90

Table 2: Descriptive statistics of control variables

We can see that participants are distributed mainly in companies operating in aeronautics, Information Technology and Energy & Transportation. Overall participants have spent a rather limited number of years in their role (average is less than 5 years). As a matter of fact 140 participants (30% of our sample) were rather new to the role since they had spent less than 1 year in their current role.

We assessed common method bias (CMB) according to what is suggested by Podsakoff et al. (2003). Specifically we adopted two different approaches. In the first one, we compared by means of exploratory factor analysis three models: a single-factor model, a four-factors model (one factor for each main variable), a 32-factors model (one factor for each main variable for each competence we considered). Single factor explains less than 20% of the variance, the four-factors model explains almost 50% and the 32-factor model explains more than 80% of the variance.

In the second approach, adopted a confirmatory factor analysis on competing models that increase in complexity. If method variance is a significant problem, a simple model (e.g. a single-factor model) should fit the data as well as a more complex model (in this case, a 32-factors model). The improved fit of the 32-factors model over the simple model was statistically significant: the change in χ^2 is 3252.9 and the change in df is 31 ($p < 0.001$). Thus, CMB did not appear to be a problem in our analysis.

EMPIRICAL RESULTS

Analyses were conducted by means of linear regression. Specifically we analyzed the described model at competence level thus 8 regression models were tested, one for each competence impacted by the training program (i.e. bidding, cost management, performance control, resource management, risk management, scope management, time management, value management).

In all regression analyses three models were compared:

- M1: this model considered only control variables; in particular we reported results considering only significant control variables
- M2: this model considers the direct effect of the defined variables
- M3: this model considers the interaction effect of Role-Training Matching (ROLE) on training effectiveness and Environment Factors (ENVIRON) on training effectiveness.

Variables were centered and standardized. Centered variables are employed to mitigate multicollinearity effects (Kleinbaum et al., 1988). Acceptable condition indices and variance inflation factors were found in all of the regressions, thus we can claim that multicollinearity is not a problem. Standardized variables are adopted in order to ensure that differences in scale among the variables did not harm the results.

Tables 3-6 provide results for the regression analyses.

	Bidding				Cost Management		
Variable	M1	M2	M3	Variable	M1	M2	M3
AEROSPACE	-0,207 (0,108) ***	0,030 (0,049)	0,039 (0,043) +	AEROSPACE	-0,685 (0,094) ***	-0,106 (0,048) *	-0,087 (0,043) *
DEFENSE	0,146 (0,193) **	0,058 (0,085) **	0,052 (0,075) **				
YEAREXP	0,109 (0,009) *	0,032 (0,004)	0,031 (0,003)				
ROLE		0,796 (0,022) ***	0,823 (0,02) ***	ROLE		0,773 (0,024) ***	0,767 (0,021) ***
ENVIRON		0,118 (0,022) ***	0,121 (0,019) ***	ENVIRON		0,111 (0,023) ***	0,094 (0,021) ***
TRAINEFF		0,255 (0,021) ***	0,283 (0,019) ***	TRAINEFF		0,382 (0,023) ***	0,391 (0,021) ***
ROLE x TRAINEFF			0,181 (0,017) ***	ROLE x TRAINEFF			0,184 (0,02) ***
ENVIRON x TRAINEFF			0,040 (0,016) *	ENVIRON x TRAINEFF			0,030 (0,018) +
R^2	0,106 ***	0,831 ***	0,869 ***	R^2	0,109 ***	0,807 ***	0,844 ***
R^2 adj	0,100 ***	0,829 ***	0,867 ***	R^2 adj	0,107 ***	0,805 ***	0,841 ***
R^2 change	0,106 ***	0,725 ***	0,038 ***	R^2 change	0,109 ***	0,698 ***	0,037 ***

Table 3: regression results for Bidding and Cost Management competences. Dependent variable: practice adoption increase. Std. estimates are provided, in brackets std. errors are reported (+ sig. <0.100, * sig. < 0.05, ** sig. < 0.01, * sig. < 0.001)**

	Performance control				Resource Management		
Variable	M1	M2	M3	Variable	M1	M2	M3
AEROSPACE	-0,568 (0,096) ***	0,039 (0,045)	0,012 (0,04)	AEROSPACE	-0,452 (0,098) ***	-0,061 (0,047)	-0,023 (0,042)
DEFENSE	0,490 (0,188) **	0,170 (0,083) *	0,119 (0,075)				
ROLE		0,829 (0,022) ***	0,804 (0,02) ***	ROLE		0,775 (0,022) ***	0,754 (0,02) ***
ENVIRON		0,146 (0,022) ***	0,132 (0,02) ***	ENVIRON		0,132 (0,023) ***	0,115 (0,021) ***
TRAINEFF		0,293 (0,021) ***	0,313 (0,019) ***	TRAINEFF		0,381 (0,023) ***	0,409 (0,021) ***
ROLE x TRAINEFF			0,170 (0,018) ***	ROLE x TRAINEFF			0,164 (0,018) ***
ENVIRON x TRAINEFF			0,042 (0,017) *	ENVIRON x TRAINEFF			0,033 (0,018) +
R^2	0,105 ***	0,83 ***	0,863 ***	R^2	0,047 ***	0,802 ***	0,839 ***
R^2 adj	0,101 ***	0,828 ***	0,861 ***	R^2 adj	0,045 ***	0,8 ***	0,836 ***
R^2 change	0,105 ***	0,725 ***	0,033 ***	R^2 change	0,047 ***	0,755 ***	0,037 ***

Table 4: regression results for Performance Control and Cost Management competences. Dependent variable: practice adoption increase. Std. estimates are provided, in brackets std. errors are reported (+ sig. <0.100, * sig. < 0.05, ** sig. < 0.01, * sig. < 0.001)**

	Risk Management				Scope Management		
Variable	M1	M2	M3	Variable	M1	M2	M3
AEROSPACE	-0,566 (0,106) ***	0,015 (0,052)	-0,01 (0,048)	AEROSPACE	-0,544 (0,096) ***	-0,067 (0,052)	-0,064 (0,049)
DEFENSE	0,394 (0,189) *	0,146 (0,088) +	0,123 (0,081)				
YEAREXP	0,021 (0,009) *	0,007 (0,004)	0,006 (0,004)				
ROLE		0,764 (0,023) ***	0,759 (0,022) ***	ROLE		0,756 (0,025) ***	0,745 (0,024) ***
ENVIRON		0,159 (0,023) ***	0,149 (0,021) ***	ENVIRON		0,133 (0,025) ***	0,132 (0,024) ***
TRAINEFF		0,306 (0,022) ***	0,330 (0,021) ***	TRAINEFF		0,344 (0,025) ***	0,364 (0,024) ***
ROLE x TRAINEFF			0,151 (0,019) ***	ROLE x TRAINEFF			0,137 (0,021) ***
ENVIRON x TRAINEFF			0,051 (0,018) **	ENVIRON x TRAINEFF			0,035 (0,021) +
R^2	0,138 ***	0,813 ***	0,845 ***	R^2	0,069 ***	0,759 ***	0,786 ***
R^2 adj	0,132 ***	0,81 ***	0,842 ***	R^2 adj	0,067 ***	0,756 ***	0,783 ***
R^2 change	0,138 ***	0,675 ***	0,032 ***	R^2 change	0,069 ***	0,690 ***	0,027 ***

Table 5: regression results for Risk Management and Scope Management competences. Dependent variable: practice adoption increase. Std. estimates are provided, in brackets std. errors are reported (+ sig. <0.100, * sig. < 0.05, ** sig. < 0.01, * sig. < 0.001)**

	Time management				Value management		
Variable	M1	M2	M3	Variable	M1	M2	M3
AEROSPACE	-0,52 (0,096) ***	-0,018 (0,044)	-0,006 (0,04)	AEROSPACE	-0,240 (0,111) ***	0,030 (0,048)	0,018 (0,041)
				ENERGY & TRANSPORT	0,110 (0,138) **	-0,013 (0,058)	-0,006 (0,050)
				YEAREXP	0,137 (0,009) ***	0,009 (0,004)	0,015 (0,003)
ROLE		0,780 (0,022) ***	0,771 (0,02) ***	ROLE		0,851 (0,021) ***	0,840 (0,019) ***
ENVIRON		0,139 (0,022) ***	0,128 (0,02) ***	ENVIRON		0,169 (0,020) ***	0,144 (0,018) ***
TRAINEFF		0,346 (0,021) ***	0,368 (0,02) ***	TRAINEFF		0,216 (0,020) ***	0,268 (0,018) ***
ROLE x TRAINEFF			0,160 (0,018) ***	ROLE x TRAINEFF			0,179 (0,016) ***
ENVIRON x TRAINEFF			0,031 (0,016) +	ENVIRON x TRAINEFF			0,062 (0,016) ***
R^2	0,064 ***	0,825 ***	0,855 ***	R^2	0,132 ***	0,852 ***	0,891 ***
R^2 adj	0,062 ***	0,824 ***	0,853 ***	R^2 adj	0,126 ***	0,850 ***	0,889 ***
R^2 change	0,064 ***	0,761 ***	0,03 ***	R^2 change	0,132 ***	0,720 ***	0,039 ***

Table 6: regression results for Time Management and Value Management competences. Dependent variable: practice adoption increase. Std. estimates are provided, in brackets std. errors are reported (+ sig. <0.100, * sig. < 0.05, ** sig. < 0.01, * sig. < 0.001)**

The overall results provide evidence that control variables, when explicative variables are considered aren't significant thus we can claim that the considered model is significant. Besides, all R^2 are high and their increases are always significant, moving from M1 towards M3.

We can also see that direct effects are all significant in M2 and that their effect is significant also when conjoint effects are considered. This provides evidence that all three variables have a strong explicative power on how project managers improve their capabilities. Specifically ROLE seems to highly contribute to explain the practices adoption increase (std. estimate is always the highest compared to the other considered variables). Training effectiveness seems to play a relevant role too (its std. estimate is always higher than ENVIRON's one). Based on this result we can state that our first research proposition (RP1) can be accepted.

When joint effect are considered we obtain interesting results. First of all, direct effects are all still significant, thus providing evidence that training effectiveness has indeed a positive impact on how project managers improve their applied capabilities. Second joint effects are all significant and with a positive impact on practice adoption improvement. Thus we can accept RP2 and RP3 concerning the interaction effects of both ROLE and ENVIRON on TRAINGING.

The positive conjoint effect between ROLE and training effectiveness provides evidence that if training activities are offered coherently with the expected role, this has an additive effect and increases participants' capabilities to improve project management practices.

Similarly, based on the positive conjoint effect between ENVIRON and training effectiveness, we can claim that training programs are more effective when the organizational context is supportive in the application of the acquired competences. Thus, even if proper training has still a positive impact on participants' capability to improve, this can be more beneficial if it is properly designed and fit to the context where the participant operates.

Even if some differences are found among the different competences, we can see that essentially all regression analyses confirm these results.

DISCUSSION AND CONCLUSIONS

Previous analyses provide strong evidence on the important impact that training can have in improving project managers behaviors.

Unlike other previous studies that suggested a lack of correlation among the measures identified at different levels of the Kirkpatrick's hierarchical model (Alliger & Janak, 1989; Alliger, Tannenbaum, Benett, Traver & Shotland, 1997), these results provide evidence of a clear relationship between the learning (level II) and the behaviors (level III).

This work also highlights the conjoint effect that both Role-Training Matching and Environment Factors have on the impact of training on behaviors. Our results provide evidence that the relationship between Training Effectiveness and Behavior Frequency Increase is influenced both by the coherence between training activity and the role of trainees and by the context in which trainees operate. This result allows to conclude that in designing a formal and objective training evaluation system, not only it is necessary to go beyond the measurement of the reaction level (Bates, 2004; Michalski & Cousins, 2000), but also to consider all the Kirkpatrick's level can be not enough. In other words, our results suggest to complete the Kirkpatrick's model adding two main variables impacting the causal relationship between level II and Level III (see Figure 3).

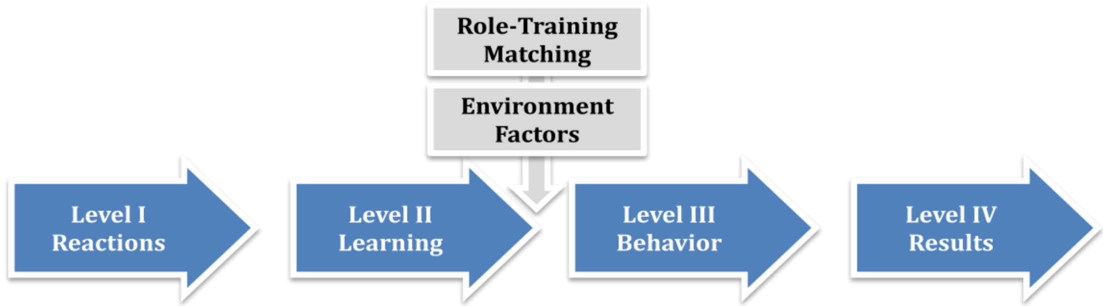

Figure 3: Proposed change to Kirkpatrick's model

Our also results allow to drive some relevant variables that companies should manage properly when designing a training program:

- Environmental conditions in which trainees operate: the context where trainees operate has a strong and relevant impact on the effectiveness of training programs, thus companies should properly evaluate it before designing and implementing training actions.
- Role-training matching: major attention should be paid to design activities coherent with what trainees' role is. It is important to underline that the existence of a competence model allow to measure to what extent the real roles match it and to what extent the training activities do the same. Thus it allows to measure the role-training matching.

The contribution of the paper is thus to provide empirical evidence of the conditions that influence the effectiveness of training activities.

We would like also to highlight the limitations of this work. First of all, we should consider that data refers to a single training activity. Even if the specific training program has involved several project managers in different operating companies, evidence from different contexts would allow to replicate results and to confirm the extent of these results. Second, only 8 competences - i.e. those relevant for the considered companies - have been analyzed. Results confirm the mentioned results for the different competences, however including also other competences would confirm the overall implications of this work.

APPENDIX

Competence	ID	Variable	Mean	Std. Dev	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Bidding	1	Role	0,697	0,372	1																															
	2	Improv	0,425	0,263	,855**	1																														
	3	Train	0,668	0,183	,073	,351**	1																													
	4	Cont	0,847	0,131	,275**	,418**	,299**	1																												
Cost management	5	Role	0,792	0,328	,516**	,438**	-,019	,161**	1																											
	6	Improv	0,460	0,243	,448**	,552**	,220**	,303**	,788**	1																										
	7	Train	0,640	0,176	-,002	,201**	,602**	,235**	-,068	,364**	1																									
	8	Cont	0,838	0,124	,139**	,292**	,271**	,681**	,195**	,397**	,344**	1																								
Performance control	9	Role	0,734	0,328	,530**	,453**	-,064	,138**	,638**	,543**	-,068	,154**	1																							
	10	Improv	0,437	0,236	,448**	,550**	,190**	,296**	,510**	,658**	,226**	,355**	,834**	1																						
	11	Train	0,674	0,170	,058	,269**	,744**	,280**	-,038	,239**	,684**	,299**	-,058	,294**	1																					
	12	Cont	0,842	0,126	,134**	,266**	,265**	,699**	,121*	,315**	,260**	,729**	,177**	,392**	,331**	1																				
Resource management	13	Role	0,817	0,280	,460**	,409**	-,009	,178**	,657**	,540**	-,069	,178**	,648**	,548**	-,006	,136**	1																			
	14	Improv	0,478	0,220	,356**	,487**	,258**	,316**	,523**	,672**	,269**	,370**	,524**	,637**	,266**	,318**	,780**	1																		
	15	Train	0,659	0,161	-,034	,167**	,619**	,217**	-,066	,233**	,694**	,268**	-,054	,201**	,625**	,230**	-,065	,367**	1																	
	16	Cont	0,823	0,125	,146**	,289**	,264**	,692**	,167**	,341**	,301**	,727**	,111*	,272**	,259**	,654**	,164**	,381**	,293**	1																
Risk management	17	Role	0,785	0,357	,570**	,482**	-,030	,154**	,565**	,469**	-,107*	,083	,647**	,526**	-,045	,096*	,617**	,479**	-,103*	,111*	1															
	18	Improv	0,474	0,267	,522**	,612**	,208**	,297**	,463**	,592**	,186**	,258**	,551**	,657**	,227**	,264**	,534**	,613**	,163**	,272**	,809**	1														
	19	Train	0,684	0,189	,071	,255**	,669**	,257**	-,033	,223**	,665**	,223**	-,011	,243**	,715**	,218**	,040	,283**	,617**	,238**	,008	,370**	1													
	20	Cont	0,845	0,132	,187**	,339**	,298**	,731**	,130**	,331**	,317**	,735**	,160**	,360**	,332**	,715**	,149**	,342**	,287**	,691**	,216**	,440**	,343**	1												
Time management	21	Role	0,818	0,289	,455**	,405**	,018	,097*	,564**	,467**	-,068	,095*	,680**	,570**	-,021	,091	,681**	,552**	-,059	,097*	,647**	,552**	,079	,130**	1											
	22	Improv	0,494	0,223	,369**	,495**	,257**	,262**	,448**	,621**	,265**	,305**	,575**	,696**	,267**	,303**	,561**	,717**	,253**	,313**	,519**	,651**	,323**	,328**	,811**	1										
	23	Train	0,669	0,156	,019	,236**	,658**	,239**	-,037	,279**	,747**	,323**	-,002	,293**	,707**	,279**	-,030	,301**	,746**	,305**	-,030	,248**	,669**	,306**	,014	,399**	1									
	24	Cont	0,845	0,131	,133**	,277**	,280**	,656**	,153**	,333**	,285**	,780**	,171**	,354**	,271**	,678**	,177**	,372**	,252**	,757**	,149**	,315**	,264**	,709**	,171**	,380**	,315**	1								
Scope management	25	Role	0,849	0,254	,517**	,448**	,000	,159**	,561**	,438**	-,094*	,101*	,564**	,465**	-,015	,096*	,639**	,478**	-,105*	,108*	,598**	,492**	,033	,124**	,656**	,509**	-,039	,144**	1							
	26	Improv	0,521	0,210	,437**	,517**	,219**	,302**	,483**	,606**	,214**	,295**	,497**	,603**	,228**	,304**	,569**	,694**	,221**	,306**	,516**	,602**	,255**	,315**	,561**	,679**	,245**	,346**	,774**	1						
	27	Train	0,694	0,153	,010	,165**	,562**	,216**	,029	,272**	,644**	,304**	,043	,254**	,569**	,231**	,049	,350**	,749**	,259**	-,022	,193**	,577**	,281**	,025	,285**	,658**	,270**	-,022	,360**	1					
	28	Cont	0,838	0,130	,153**	,272**	,275**	,660**	,122**	,286**	,271**	,750**	,110*	,284**	,268**	,677**	,155**	,344**	,272**	,774**	,110*	,261**	,229**	,711**	,093*	,290**	,288**	,755**	,139**	,339**	,280**	1				
Value management	29	Role	0,639	0,408	,614**	,532**	-,007	,202**	,596**	,502**	-,049	,148**	,693**	,567**	-,047	,168**	,515**	,426**	-,029	,116*	,614**	,547**	,015	,209**	,530**	,457**	,014	,140**	,488**	,451**	,041	,101*	1			
	30	Improv	0,366	0,266	,548**	,620**	,189**	,327**	,496**	,583**	,168**	,307**	,582**	,648**	,181**	,322**	,446**	,524**	,173**	,243**	,513**	,612**	,213**	,345**	,458**	,559**	,239**	,273**	,409**	,525**	,198**	,241**	,866**	1		
	31	Train	0,653	0,199	,064	,235**	,691**	,241**	-,078	,168**	,657**	,258**	-,086	,166**	,763**	,243**	-,082	,176**	,579**	,236**	-,066	,177**	,705**	,281**	-,009	,226**	,636**	,278**	-,029	,172**	,513**	,247**	-,045	,238**	1	
	32	Cont	0,830	0,132	,184**	,340**	,283**	,737**	,087	,276**	,287**	,703**	,112*	,296**	,305**	,721**	,122**	,316**	,271**	,664**	,092	,271**	,282**	,710**	,064	,261**	,277**	,652**	,105*	,303**	,253**	,673**	,235**	,437**	,316**	1

Table 7: descriptive statistics and correlations among considered variables

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