EVALUATION OF ENTERPRISE TRAINING PROGRAMS USING BUSINESS PROCESS MANAGEMENT

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Abstract: The investment in human capital, by means of training delivered in enterprise, became an important constituent of enterprise competitiveness strategy. Consequently business managers require from their human resources managers, training departments, or even of consultants working in the field of training, the proofs of training investment yield in terms of tangible and intangible profits.
To evaluate training in enterprise, two models predominate, namely the model of Kirkpatrick and that of Phillips. In this paper, we propose an approach of training project evaluation, based on business process management. It is an approach which fills the gaps raised in the literature and ensures an alignment between training activities and business needs.

1 INTRODUCTION AND PROBLEMATIC

Individual and collective skills are the most important assets for organizations, and determine their productivity, competitiveness and ability to adapt and to be proactive when uncertain. Training is a key strategy for generating skills in people. This is why investment in training is high; the American Society for Training & Development (ASTD) estimated this investment to 126 billion USD in 2007 (Paradise, 2007).

Many organizations assess whether learners liked a course or acquired new knowledge, but few have cracked the code on how to determine learning Return On Investment (ROI). The most commonly used metrics for evaluating training programs are those derived from the work of Donald L. Kirkpatrick (Kirkpatrick, 1994) and Phillips (Phillips, 1996). Table 1 shows the measures of course evaluation reported in the 2008 Benchmarking Study conducted by Corporate University Xchange.

There are several models in the literature. Some of these models allow calculating the return on the invested capital, and could help organizations to make better educated decisions regarding workforce training. However, because of the difficulties bound to the use of these models, human resource departments cannot estimate, in a concrete way, the impact of the training on the economic and social growth of their enterprise.

Table 1: Course Evaluation Methods by Level, in (Rozwell, 2009).

Course Evaluation Method	**Percentage of Courses Evaluated Using this Method**
Level 1: opinion of the course and instructor	75%
Level 2: knowledge acquisition	47%
Level 3: behavior change	20%
Level 4: business impact	12%
Level 5: return on investment	6%

A study, led by ASTD and Institute for Corporate Productivity's (i4cp), shows that few organizations feel they have mastered the learning evaluation, and many admit to face ongoing challenges (Patel, 2010). Besides, methodological problems are also highlighted by respondents, in particular for evaluation levels 3, 4 and 5 (the level 5 corresponds to Phillips' model) and isolation of training effects in the results.

In this paper, we propose a training project management approach based on business process management: going from concept to optimization, via the evaluation of the financial and non financial yield.

In the remainder of this paper, we shall present, in section 2, the two basic models for evaluating the training in enterprise, the advantages and criticism of

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these models. Section 3 will be dedicated to the presentation of our model and a final conclusion is presented in section. 4.

2 THE KIRKPATRICK/PHILLIPS MODEL

The concept of yield covers a rather wide spectrum, going from effect perception to the return on investment calculation. These two dimensions join the distinction between ”financial yield” to describe the measure or the calculation of what the training brings to the organization on financial plan and ”training results” to describe the impact or the effects which are not of financial nature.

Kirkpatrick’s model began in 1959, with a series of four articles on the evaluation of training programs in the journal ”Training and Development”. These four articles defined the four levels of evaluation that would later have a significant influence on corporate practices.

The four levels of Kirkpatrick’s evaluation model essentially measure (Kirkpatrick and Kirkpatrick, 2006; Kirkpatrick, 1994):

Level 1 - Students Reaction
How did the trainees react after the training? Did they appreciate this one? Are they satisfied? What they thought and felt about the training.

Level 2 - Learning
What they learnt after the training? What knowledge, skills and/or attitudes (knowledge, know-how, and social skills) have been acquired? Have educational objectives been achieved? The resulting increase in knowledge or capability. It is about the educational evaluation.

Level 3 - Behavior
Do the trainees use what they learned in training at their workstations? What new professional behaviors have been adopted? Extent of behavior and capability improvement and implementation/application.

Level 4 - Results
What is the impact of the training on the results of the company? Example: decrease of the rate of absenteeism, occupational accidents, growth of turnover, the productivity, customer satisfaction, etc. The effects on the business or environment resulting from the trainee’s performance.

Although the four-level model of Kirkpatrick is widely recognized and accepted, and although a significant number of evaluation methods find their base there, many have argued that this method does not provide the data required by managers today, which Phillips has to overcome.

According to Phillips, the calculation of the yield of the training is made by means of a process by stages which supplies a plan detailed for *the planning, the collection and the data analysis*, which includes the calculation of ROI (Phillips, 1996; Phillips and Stone, 2002; Phillips and Phillips, 2003). The process begins with the evaluation planning: where objectives are developed and decisions are taken on the way the data will be collected, treated, and analyzed. The data collection is made according to training evaluation levels (*level 1: reactions/satisfaction; level 2: learning; level 3: transfer of the learning and the level 4: the organizational results*). Finally, at the level of the data analysis, we have the crucial stages for the analysis of ROI:

- **Isolate the effects** of the training from other factors of influence (use of one or several methods to separate the influence of the training project of the other factors which influence the measure of the organizational results),
- **Convert the data** concerning the organizational impacts into money values for developing an annual value of the project,
- Profits and costs are combined in the **ROI calculation**,
- **The intangible profits** are identified by this process (they are included in this category only after having tried to convert them in money values).

In conclusion, training is a key strategy for staff development and for achieving organizational objectives. Organisations and public authorities invest large amounts of resources in training, but rarely have the data to show the results of that investment. Only a few organisations evaluate training in depth due to the difficulty involved and the lack of valid instruments and viable models (Pineda, 2010). The entire notion of the Kirkpatrick/Phillips model may not truly measure the impact of the Learning Function on the organization, even under the most optimistic scenarios. It measures only the possible impact of isolated training events (Mumma and Thatcher, 2009).

Thus, to try to bring a solution to the enterprise needs, we present in the following section an approach of training yield evaluation, based on the business process management.

3 A MODEL OF TRAINING EVALUATION BASED ON BUSINESS PROCESS MANAGEMENT

Business Process Management (BPM) represents a strategy of managing and improving business performance by continuously optimizing business processes in a closed-loop cycle of modeling, execution, and measurement. A global study by Gartner confirmed the significance of BPM with the top issue for CIOs identified for the sixth year in a row being the improvement of business processes (Gartner, 2010).

Given the success registered by the BPM solutions in the management of enterprise processes, why not use this approach to manage, efficiently, the training activities in enterprise? An affirmative answer to this question supposes that we have to consider these activities as being business processes.

Indeed, to design and realize a training project supposes getting through various stages: going from the formulation of a request up to the implementation of new skills. The reality in most enterprises is that they need to figure out how to make their spending for training have a greater impact on corporate performance. When training needs are viewed with a critical eye, many organizations will find that they simply do not have enough money to train every employee equitably. So they need to focus their training expenditure on the roles that are most essential for business success and that return the most value to the organization. That's why, for the management of the training projects in enterprise, we propose an approach based on five stages, as shown in Figure 1.

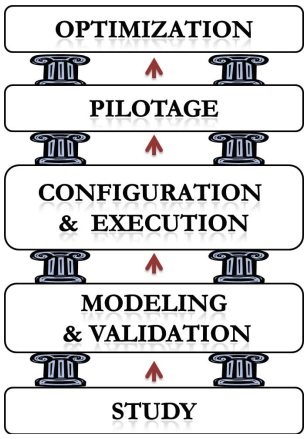

Figure 1: Steps of management of a training program in enterprise.

In the following subsections we present the stages of our approach. To facilitate the understanding, we use the following sample scenario:

In an enterprise of software development, the financial manager notes an increasing of penalties owed to the delivery delay. After analyzing the situation , he remarks that the delays are bound to projects which integrate the programming in Xforms. Hence, the enterprise decides to offer an accelerated training to its employees. The training cost is estimated at 72000$. *The training is offered in the afternoons (therefore, employees work half-time). How to insure a simple and effective management of this project?*

3.1 Stage 1: Study of Training Project

The first stage of our approach consists of analyzing the demand for training and associating it with elements of performance of the enterprise. It is translated by a certain number of actions such as: the conversations of exploration of the demand, the definition of a plan of change, needs analysis, definitions of the objectives, the definition and the choice of performance indicators.

In the scenario above, it is important to isolate, first of all, indicators associated to the problem: *cost of delay in delivery, number of software delivered late, cumulative time of delay. . . .*

Necessary to take into account factors which can have the same effect. These correspond to the following indicators:*staff turnover rate, employee's absenteeism rate,number of absence per employee, reason of absence, cost of rotation, cost engendered by the absenteeism, cost of absence per employee, job satisfaction degree, personal initiative degree, staff productivity, collaboration level between employees within the enterprise, collaboration level per employee. . . .*

Having identified factors bound directly or indirectly to the problem, it is necessary to calculate the real cost of training for the ROI calculation. For our scenario, we must add the losses incurred by the enterprise during the training period, the cost of time devoted to the identification, and needs analysis (combined time of employee, supervisor. . .). Finally, it is necessary to define the objectives of the training and to link them to enterprise business needs. In our scenario, it is to decrease the "cumulative delay time "that is linked to the turnover of the enterprise by the cost of delay penalties. In other words, it is a question of insuring an alignment between the objectives of the training and the business needs.

3.2 Stage 2: Modeling and Validation

To model a business process, we use graphic objects

developed by Workflow Management Coalition (WFMC, 1999).

A business process model can contain two types of structural conflict: *deadlock* and *lack of synchronization* (Sadiq and Orlowska, 1999; van der Aalst et al., 2002; Lin et al., 2002; Sadiq et al., 2004). In order to verify or to assure the correctness of a process model, we use an algorithm based on reduction-based algorithms and graph-traversal algorithm (Touré et al., 2008).

For the management of a training project, there are at least two process models: the process model bound to the training planning and the process model bound to the stages of evaluation of the training yield (including the stages of evaluation presented in the section 2). In this stage, we define indicators allowing evaluating the training. These indicators allow reacting in real time to push aside any situation which can lead to the failure of the training (non-achievement of objectives).

The training planning is a graphic representation of training progress stages. Figure 2 shows a possible process model, corresponding to our example (the software development enterprise).

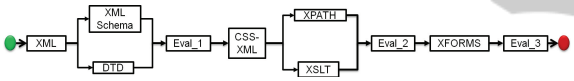

Figure 2: A possible process model for training planning.

We associate to this graph (Figure 2), the actors of each stage, the temporal aspect and the performance indicators linked to the training conduct. As indicators, we can quote: *average emotional state per learner, average emotional state per training session, general emotional state per training, satisfaction as for the training program organization, satisfaction as for the contents, satisfaction towards the trainer, relevance of the perception, the utility and capacity of the training to reach its objectives, note by examination, average score of learning,...*.

The training evaluation planning is a representation of information collecting stages, during and after the training (Figure 3). With this graph, we must define the collecting means, the date, the objectives, the actors and corresponding indicators. We also define indicators allowing estimating the achievement of the objectives of the training in enterprise. These indicators are related to employee's life in the company after the training. We can add for example: *increase of innovation degree of an employee, increase of innovation degree in the enterprise, improvement of the quality of the product, climate at work, number of committee meetings, customer loyalty, earnings per employee, ROI...*.

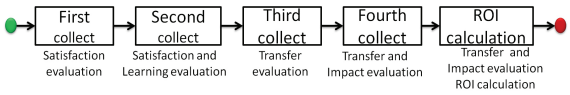

Figure 3: A possible process model for training evaluation planning.

After the modeling, we must validate the process models by taking into account the structure, actions, data flows and the temporal aspect.

3.3 Stage 3: Configuration and Execution

A Business Process Management System (BPMS) is an integrated collection of software technologies that enables the control and management of business processes. Compared with other model oriented development tools, such as integrated service environments and integrated development environments, a BPMS emphasizes business user involvement in the entire process improvement life cycle. As a discipline, BPM is about coordination, rather than control (via automation) over resources. Beyond task automation, a BPMS coordinates human interactions and information flows in support of work tasks. People, information, systems and, increasingly, business policies are treated as equally important resources that affect the desired work outcome. This comprehensive approach to resources also distinguishes a BPMS from other emerging model-driven application infrastructure (Gartner, 2009).

This stage is dedicated to the evaluation before and during the execution, the initialization of indicators by their current values in the enterprise before the execution of the project of training. The choice of indicators depends on the type of training and especially the target objectives of the enterprise.

The execution corresponds to the operational phase where the solution of BPM is implemented. It is in this stage that the evaluation of levels 1, 2 and sometimes level 3 of the model of Kirkpatrick (during execution some of indicators will already be under observation) is performed.

3.4 Stage 4: Monitoring

This stage consists in controlling the progress of the processes. A control based on precise indicators and relevant in order to have dashboards allowing making quickly the good decisions. The dashboard of the training has to cover two big dimensions: the efficiency and the efficacy. The training process said to be efficient if it gives the maximum of results by

consuming the minimum of resources and said to be effective if it gives the expected results.

The dashboard of the efficiency of the training will be composed of indicators of consumption of resources and of activities output allowing measuring the efficiency of each of the three stages of the process, as well as the general efficiency of the training project. The following indicators allow building the dashboard of the efficiency of a training program: time dedicated to the identification and to the needs analysis (combined time of the employee, his superior and the training manager), perceived usefulness of the training/time dedicated, the gap enters what the employee masters and what he has to master, the adequate level of training to reduce or cancel the gap (beginner, intermediate, advanced), mode of training (external, intern, coaching, e-learning, tutoring, etc.), time to design and the elaboration of the program, etc. These indicators can be analyzed by sex, seniority, social status, type of training, or operational unity (service, department, store, etc.). The dashboard of the effectiveness focuses either on the effectiveness of a training, or on the global effectiveness of the training system. Its structure includes the model of training evaluation and contains more indicators than the efficiency dashboard.

This stage allows us to calculate the tangible and intangible training benefits (without additional costs) by using indicators values.

3.5 Stage 5: Optimization

In this stage of our approach, we use machine learning algorithms (example, logistic regression, neural networks or support vector machines) to *classify training activities* according to defined criteria (example, financial yield) and to *do simulations* to increase the efficiency and efficacy of training activities. For this, we realize a pretreatment on the indicator values to have a data set for a supervised learning algorithm, unsupervised or semi-supervised.

When the training evaluation process is completed, the enterprise training programs will be classified in two categories: profitable and unprofitable. Hence, we will have a dataset D_n that can be used in training of a machine learning algorithm.

$$D_n = \{Z_1, Z_2, \ldots, Z_n\}$$
$$\forall i \in \{1,2,\ldots,n\}, Z_i = (x^{(i)}, y^{(i)}) \text{ with } x^{(i)} \in \mathbb{R}^d \text{ and } y^{(i)}) \in \{0,1\}$$

Each Z_i is associated to a particular training program in the enterprise. The $x^{(i)}$ are the indicators (see 3.1 and 3.2) related to the training, $y^{(i)}$ represents the training class (*profitable or unprofitable*), **n** is the number of completed training program and **d** is the number of indicators.
It is obvious that to use this data set with a machine learning algorithm, it is necessary to make a pretreatment to *standardize* or *normalize* the inputs $x^{(i)}$.

The purpose of the classification is to be able to predict the achievement or none achievement of the training objectives by observing only the indicators behavior. Furthermore, we must be able to determine the indicators which have more weight in the realization of training objectives. That's why we may use a parametric machine learning algorithm like logistic regression, neural networks or the support vector machines.

The optimization consists of a simulation allowing guiding the training process towards objectives achievement. To do this we may use semi-supervised learning. Semi-supervised learning is of great interest in machine learning and data mining because it can use readily available unlabeled data to improve supervised learning tasks when the labeled data are scarce or expensive. Semi-supervised learning also shows potential as a quantitative tool to understand human category learning, where most of the input is self-evidently unlabeled (Zhu and Goldberg, 2009).

To materialize our approach, our objective is to provide a tool (Figure 4) to help the training projects management in enterprise with the alignment between the training activities and business needs, modeling and validating of the training processes, execution and supervision of training projects, calculation of tangible and intangible profits of training, classification of trainings (in two levels: enterprise - employee), trainings optimization (in two levels: employee - enterprise).

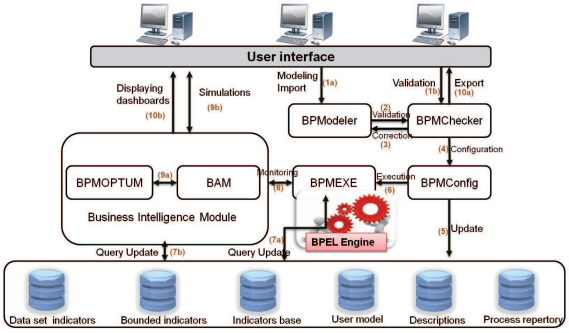

Figure 4: Architecture of our enterprise training processes management system.

4 CONCLUSIONS

Business Process Management (BPM) was once de-

fined in terms of tools and technologies, it has recently emerged as a discipline encompassing a broad spectrum of organizational practices. As a result, the skillsets for BPM endeavors of today's organizations have gone beyond the automation of processes to encompass a wide variety of strategic and technical skills (Antonucci, 2010). The advantages obtained through our approach can be seen from two angles. In the domain of business process management, we add a new category of business process and extend BPMS by adding the validation pre-execution (through our tool).

Concerning the evaluation of enterprise training, we propose a complete approach of training project management facilitating decision-making and the calculation of the tangible and intangible profits. With regard to the existing models, we add a level of diagnostic (classification and optimization) allowing to understand the dysfunctions related to the attainment or not attainment of training objectives. Our approach ensures the training activities alignment with business needs and allows the ROI calculation without additional investment.

Concerning the problems raised in the literature, we reduce the bias and additional costs bound to training yield calculation. Indeed, from the beginning, we associate the effects expected by the training with certain indicators that it already uses in the current management of the enterprise. When financial yield evaluation is required, it will be thus able, without additional costs, to provide data on the quantitative indicators which will show the evolution of productivity and quality and will be able to translate them into economic value.

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