AM2O
An Efficient Approach for Managing Training in Enterprise

Fodé Touré[1], Esma Aïmeur[1] and Kimiz Dalkir[2]
[1]*Department of Computer Science and Operations Research, Université de Montréal, Montreal, Canada*
[2]*School of Information Studies, McGill University, Montreal, Canada*

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Abstract: The learning function has grown and matured considerably in recent years, and evolved into a strategic support function. Companies continue to invest in organizational learning and development, but rarely possess data to assess the results of this investment. Most companies use the Kirkpatrick/Phillips model to evaluate enterprise training. However, it emerges from the literature that enterprises have difficulties in using this model.
In this paper, we propose an approach based on analysing and modelling the training needs to ensure the alignment between training activities and enterprise business objectives. It allows training project monitoring as well as the calculation of tangible and intangible benefits of training (without added cost). Furthermore, it enables the production of a classification of training projects according to criteria relevant to the enterprise. Our approach can be used to optimize the training yield by a series of simulations based on machine learning algorithms.

1 INTRODUCTION

The training evaluation aims at verifying if the committed efforts are translated by the outcomes which matched the aimed objectives. However, when it is question of making the link between learning programs and business results, organizational learning functions have a track record of limited success.

A 2009 ASTD study revealed that the five-level *Kirkpatrick/Phillips* model of learning evaluation is the most commonly used model in practice. However, few organizations feel they have mastered the learning evaluation, and many admit to facing ongoing challenges (ASTD, 2009). The barriers that prevent companies from using all the evaluation levels are:

- **Difficulty in isolating learning** as a factor that has an impact on corporate results.
- **Lack of a useful evaluation system** within the Learning Management System (LMS).
- **Lack of standardized data** to properly compare across training functions.

This paper presents a method of training project management (AM2O method): going from design to optimization via the evaluation of the financial and non-financial yield. It also introduces our *Enterprise Training Program Management System - ETREOSys*.

In section 2, we present our approach (AM2O method). Section 3 provides a brief presentation of the Kirkpatrick/Phillips model for the evaluation of training programs in organizations. In section 4, we discuss our results and section 5 is reserved for the conclusions.

2 AM2O: AN APPROACH FOR ENTERPRISE TRAINING PROGRAM MANAGEMENT

We propose a four-step approach of enterprise training program management. This approach consists of analysing training needs, process modelling, monitoring the progress of a project while guaranteeing expected objectives, and optimizing the yield by a series of simulations. These four steps are shown in Figure 1.

2.1 Stage 1 - Analysis

A corporate training program consists of a series of

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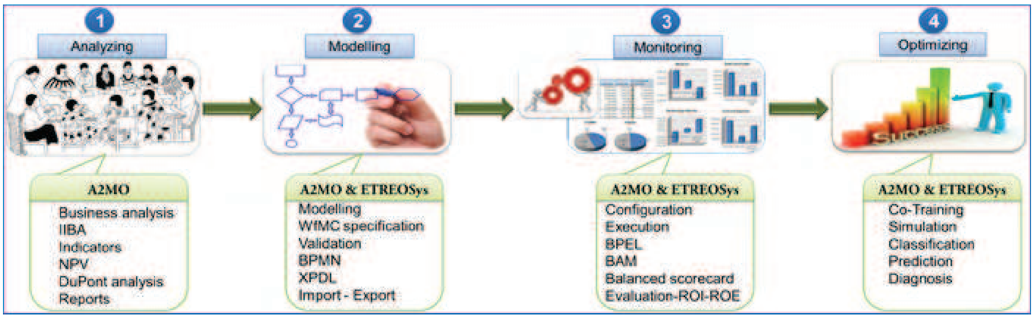

Figure 1: The stages of AM2O method.

specific actions intended to resolve an enterprise-specific problem. According to Rivard and Lauzier (2013), a need for training in an enterprise defines itself by the gap between what is (*the current situation*) and what should be (*the wished situation*). It is thus necessary to avoid launching too quickly a training process before having well estimated the nature of the problem raised in the enterprise.

The results of a study led by van Eerde et *al*. (2008), with 96 companies, demonstrate that a rigorous analysis of needs leads to a greater perception of the utility of training, what in return has a positive effect on the efficiency of the organization. Hence, the first stage of AM2O focuses on analysing the demand for training and associating it with performance elements of the enterprise. This stage requires a number of actions such as: consultations to explore demand, definition of a change plan, needs analysis, definitions of the objectives, and selection and definition of performance indicators. Hence, we use a business analysis process based on the International Institute of Business Analysis (IIBA) guide.

IIBA maintains and publishes a repository containing a description of the activities involved in business analysis. The repository is published as a book entitled ”*A Guide to the Business Analysis Body of Knowledge*”(IIBA, 2009).

The development of systems and their components is based on the description of needs. The determination of the needs depends on the form and the structure of the demand. The IIBA guide allows us to answer several questions such as: *Why would you want to train employees? What needs have been identified? What are the expectations? How will the achievement (or not) of goals be assessed?*

The analysis of the current situation produces a report containing a structured presentation of harvested information and details of the objectives, the means and available resources, improvement proposals, risks and potential impacts. Managers evaluate the organizational strengths, weaknesses, opportunities and risks. A business process model is therefore based on the identification of key elements in the conduct of affairs such as endogenous and exogenous factors directly acting on the fluctuations of the functioning mode of the enterprise. This reasoning solves the problem of isolation of training impacts from the overall performance of the organization. Indeed, we can use the IIBA process to define the indicators related to the expected effects of the training and the factors that may influence these effects. This means that we also define the situations and indicators that can produce the same effects as training.

In AM2O, the description of the intangible training yield is based on the values of qualitative indicators. As these indicators are directly linked to specific objectives, the successful achievement of these objectives will be evaluated using the values of the corresponding indicators. The same reasoning applies to the calculation of the financial training yield.

This first stage of AM2O supplies the process model, the information required to configure this model, and the initial values of indicators. It ensures the alignment of the training program with the growth strategy of the enterprise. At this stage, we estimate the *Net Present Value* (NPV) of the training investment before the beginning of the training program by combining the NPV formula with the *DuPont financial analysis method*.

When a company or investor takes on a project or investment, it is important to calculate an estimate of how profitable the project or investment will be. NPV is a formula used to determine the present value of an investment from the discounted sum of all cash flows received from the project. It compares the value of a dollar today to the value of that same dollar in the future, taking inflation and returns into account. The formula for the discounted sum of all cash flows can be rewritten as:

$$NPV = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t} - C_0 \quad (1)$$

T is the number of years, C_t is the cash flow at time t, r is the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk - it is the interest rate) and C_0 is the initial investment.

The cash flow is the movement of money into or out of a business, project, or financial product. It is usually measured during a specified, finite period of time. Measurement of cash flow can be used to calculate other parameters that give information on a company's value and situation. For example: to improve the yield of its shipping department, a warehouse (Enterprise X) organizes training sessions for its employees on the use of scanners.

The analysis of the need for training shows that Enterprise X just wants to increase its return to investors. To increase this return, it has to reduce the cost of ordering errors and increase the number of orders treated per hour in the whole department (thus by all employees). The analysis of the current situation of the enterprise provides the simplified financial balance sheet shown in Table 1 below.

Table 1: Example of simplified financial balance sheet.

Net profit	Sales	Assets	Equity
$ 1 000 000	$ 10 000 000	$ 8 000 000	$ 4 000 000

Order errors represent an average cost of $200 000 to the company. The cost of the training is $500 000. Enterprise X estimates that training will reduce the cost of ordering errors by at least 50%. Also, increasing the number of orders treated per hour will have a positive impact on sales and net profit. This increase also saves the salary of seasonal workers, the cost of their recruitment and their training (e.g. $ 150 000). Such information can be used to estimate the NPV of the investment in training before the program begins.

In the case of Enterprise X, assuming that the training generates a constant income, for a constant risk of 10%, we have the following NPV:

$$NPV = \frac{100000+150000}{1.1} + \frac{250000}{1.1^2} + \dots + \frac{250000}{1.1^T} - 500000 \quad (2)$$

According to the previous calculation, we note that the value of NPV will be positive only from the third year onwards.

Normally, several aspects of financial statements are affected by training which makes it more difficult to estimate the impact on profit. Consequently, contrary to the previous example which was simple, in more complex cases, the calculation of the NPV of an investment in training is done in five steps (Figure 2).

Indeed, the use of the IIBA guide produces a set of indicators (ratios) for assessing the success of the training. These ratios can be used in the decomposition (first and second level) of the *DuPont model* in order to calculate the cash flows associated with the investment in training.

According to Soliman (2008) , the DuPont components represent an incremental and viable form of information about the operating characteristics of a firm. With this method, assets are measured at their gross book value rather than at net book value in order to produce a higher return on equity (ROE). It is a ratio analysis system that quickly allows us to determine if a company is using all the means at its disposal to reach its financial goal. The DuPont analysis helps locate the part of the business that is underperforming (if ROE is unsatisfactory). This analysis tells us that the ROE is affected by three sub-ratios:

- Operating efficiency, which is measured by profit margin.
- Asset use efficiency, which is measured by total asset turnover.
- Financial leverage, which is measured by the equity multiplier.

$$ROE = Profit\ Margin * Total\ Asset\ Turnover * Equity\ Multiplier \quad (3)$$

$$Profil\ Margin = \frac{Profit}{Sales}$$
$$TotalAsset\ Turnover = \frac{Sales}{Assets}$$
$$Equity\ Multiplier = \frac{Assets}{Equity}$$
$$ROE = \frac{Profit}{Equity}$$

For example, by using Table 1, we obtain the following ROE:

$$ROE = \frac{10^6}{10^7} * \frac{10^7}{8*10^6} * \frac{8*10^6}{4*10^6} = 0.25$$

The result of the calculation of the ROE means that every dollar invested in the company by the shareholders generates 25% (25*cent*) of profit.

A better analysis of the training project would be to associate indicators, supplied by the first stage of our approach, with certain ratios of the DuPont decomposition. This will help to pinpoint the exact impact of training on the return on equity (specifically on net profit). A comparative analysis with the scenario without investment in training allows us to isolate the relevant cash-flow to be used in the NPV formula.

Using the same example of Enterprise X, the reduction of the cost of ordering errors and the increase

Figure 2: Procedure for estimating the profitability of a training investment.

of the number of orders treated per hour will have an impact on the net margin ratio and the total asset turnover ratio. Thus, from the decomposition of the DuPont model, if improvements due to training increased the return on equity of β (i.e. the net profit of β), then we can use the NPV formula to determine the future earnings of investment in training according to the following equation:

$$NPV = \sum_{t=1}^{T} \frac{\beta * net\,profit}{(1+r)^t} - C_0 \qquad (4)$$

Depending on the value of NPV, and whether it is above or below a threshold set by the company, the decision will then be to either fund or not fund the training project.

2.2 Stage 2 - Modelling

This stage allows us to model a business process using graphic objects developed by the Workflow Management Coalition language. In this modelling language, we use two object types: nodes and flows. The nodes are classified into two categories: task and choice (condition). A task, graphically represented by a rectangle, represents the work to be done to achieve some objectives. A choice, graphically represented by a circle, is used to build conditional structures. A flow links two nodes in graph and is graphically represented by an arrow.

For training project management, there are at least two process models: the process model related to the training plan and the process model related to the stages of data collection and training performance evaluation.

The training plan is a graphical representation of the syllabus (course outline). To illustrate this concept, let us take the example of an enterprise, which would like to improve the performance of its customers' service department. The enterprise would like employees to make a complex analysis of consumer behaviour and communicate results to managers and strategic advisors. This means that employees must be trained on consumer behaviour. Figure 3 shows a process model of the planning of this training.

In AM2O, the actors of each activity and their roles, the description of incoming and outgoing data, the temporal aspect and the performance indicators

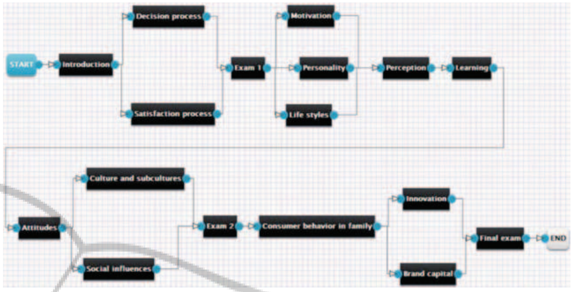

Figure 3: A possible process model for a training plan for consumer behaviour.

related to training are also added to the graph. Sample indicators may include: average emotional state of learner, average emotional state of trainees during training sessions, and satisfaction of the organization with the training program, Employees' satisfaction can be measured with such indicators as satisfaction with respect to the content, perceived relevancy and usefulness of training.

The planning of the data collection and training evaluation consists of collecting information before, during and after the training (see Figure 4). In A2MO, we define the means of data collection, dates, the objectives, the actors and the corresponding indicators for each stage. All information is kept in ETREOSys to facilitate the management of the training program. Consequently, besides the already mentioned indicators, we define other indicators that allow us to estimate the achievement of the training objectives in the enterprise. These indicators relate to the employees' lives in the enterprise before and after the training. Some examples would be: increase innovation level of an employee, increase general level of innovation in the enterprise, improve product quality, work climate, the number of committee meetings, customers loyalty, and profit by employee.

We can also isolate the indicators which can influence those previously discussed (with or without training program). For example: rate of staff turnover, rate of employee absenteeism, number of absences per employee, cause of absences, cost of the rotation, cost engendered by absenteeism, cost of absence per employee, degree of job satisfaction, degree of personal initiative, staff productivity, level of collaboration between employees within the enterprise, level of collaboration per employee and so on.

In the case of the training modelled in Figure 3, we

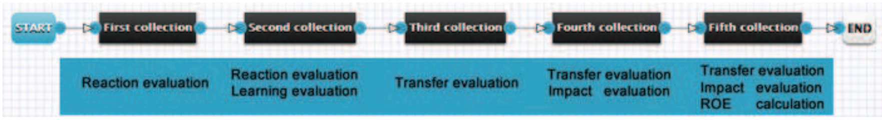

Figure 4: A possible process model for training evaluation planning.

must take into account the *influence of environmental factors* on consumer behaviour such as *culture*, *reference groups*, *social class* or *family*. Therefore, it is necessary to define indicators in order to isolate the influence of these external elements.

The evaluation process model (Figure 4) fixes periods of gathering information in order to proceed with evaluations and simulations to predict result trends. This information will allow us to make decisions leading to the success of the training program. The evaluation process model will allow us to react in real time to avoid failure of training (non-realization of the objectives). For this purpose, it is enough to compare the initial values, the collected values and the expectations of the enterprise.

The deployment of invalid processes can lead to incoherent states and can even provoke very critical breakdowns without the slightest possibility of recovery. In other words, if a process is put in production before being validated, it could fail during the execution stage and cause considerable loss to the enterprise. To check the syntactic validity, we analyse the structure of the process model. For this, we use a simplified and enhanced version of the Touré hybrid algorithm (Touré et al., 2008). On the other hand, to check the semantic validity, we need to analyse the information treated by the tasks and the behaviour of the latter (in the first stage of AM2O, see section 2.1, caution must be taken in order to avoid semantic conflicts).

The first and second stages of AM2O are important because they ensure a responsible management of the training program and serve as the basis for the success of the stages 3 and 4.

2.3 Stage 3: Monitoring

This stage of AM2O consists of controlling the progress of the processes. A control system based on relevant and precise indicators is needed in order to have dashboards used to make good decisions quickly. The training dashboard has to cover two dimensions: efficiency and efficacy. The training process is said to be efficient if it gives maximum results while consuming minimum resources and said to be effective if it provides the expected results.

This stage allows us to calculate the tangible and intangible training benefits (without additional costs) by using the values of the indicators. To estimate the impact of training on cost, we compare indicator values before training and after training. The calculation of the return on training investment is explained by the process shown in the Figure 5.

When we decide to calculate the financial yield on training investment, we determine the gap between the previous and current values of the quantitative indicators (ratios). Furthermore, the intangible benefits can be converted into tangible factors with a good understanding of profit. For example: the improvement of employee morale (intangible) can be converted as follows: improving employee morale can increase employee retention, which can be assessed as the cost saving related to hiring and training new employees. Based on staff turnover last year, the human resources department can provide concrete numbers like ”Reducing employee turnover by 5% will save $ 5,000 in recruitment costs.”

By using the DuPont model (see equation 3), we estimate the impact of the variation in ROE indicators on the ROE. This process allows us to calculate the impact of training on the overall profitability of the company.

2.4 Stage 4: Optimization

In this stage, 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 conduct simulations to increase the efficiency and effectiveness of training activities. To do that, we carry out a pre-treatment on the indicator values to have a data set for a learning algorithm (supervised, unsupervised or semi-supervised). When the training evaluation process is completed, the enterprise training programs will be classified into two categories: profitable and unprofitable. Hence, we will have a dataset D_n that can be used in the training of a machine learning algorithm.

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

Each Z_i is associated with a particular training program in the enterprise. The $x^{(i)}$ values are the indicators (see 2.1 and 2.2) related to the training. Hence,

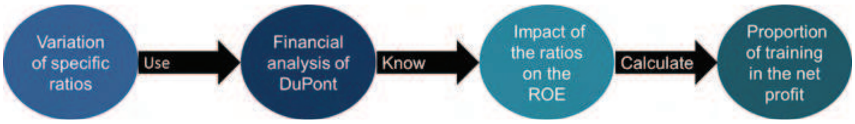

Figure 5: How to calculate the return on training investment.

we can have indicators which take numerical values (for example, number of committee meetings) and others that take categorical values (for example, ordinal and nominal values). The $t^{(i)}$ values represent the training class (profitable or unprofitable), where profitable corresponds to 1 and unprofitable corresponds to 0. The number of completed training program is n and the number of indicators is d.

In our approach, the purpose of the classification is to be able to predict the achievement or non-achievement of the training objectives by observing only the indicators behaviour. Furthermore, we must be able to determine the indicators which have more weight in the attainment of training objectives. That's why we may use a parametric machine learning algorithm like logistic regression, neural networks or support vector machines.

The optimization consists of a simulation that guides the training process towards the achievement of its objectives. To do this we may use semi-supervised learning. The goal of a semi-supervised learning is to understand how combining labelled and unlabelled data may change the learning behaviour, and design algorithms can be developed that take advantage of such a combination. For this, we need to render the values of the indicators that we want to predict as discrete variables. This is a binary classification process (the value is good or bad) based on the recommendations of a human expert. For example, the indicator *number of absences per employee* is 1 if its value is below the threshold set by a human expert (or according to the functioning of the enterprise) and 0 otherwise.

To facilitate the understanding and the use of AM2O, we developed an enterprise learning management system named Enterprise TRaining program Evaluation and Optimization System ETREOSys.

3 RELATED WORK

Work on 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 (Kirkpatrick and Kirkpatrick, 2006).

Level 1 - Students Reaction
How did the trainees react after the training? Did they appreciate it? Were they satisfied? What did they think and feel about the training?

Level 2 - Learning
What did they learn after the training? What knowledge, skills and/or attitudes were acquired? Were educational objectives been achieved? Was there a resulting increase in knowledge or capability?

Level 3 - Behavior
Do trainees use what they learned in training at their workplace? What new professional behaviours have been adopted?

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

Although the Kirkpatricks' four-level model is widely recognized and accepted, and although a significant number of evaluation methods are based on it, many researchers have argued that this method does not provide adequate data required by today's managers. According to Phillips, training yield calculation proceeds by stages, which supplies a detailed plan for the collection and analysis of the data, which includes the calculation of Return On Investment (ROI). So Phillips suggested the inclusion of a fifth level in 1996 (Phillips and Phillips, 2003).

Level 5 - Return on Investment
Comparison between the profit obtained from the training and the training costs. Profits and/or savings realized are they superior to the total cost of the training (direct and indirect costs)? Did the training generate a return on investment?

The ROI calculation process begins with planning for training evaluation: where objectives are defined and decisions are taken on the way the data will be collected, treated, and analysed. Data collection is carried out according to the training evaluation levels 1 to 4 of Kirkpatrick's model.

However, in the literature, several criticisms have been raised with regard to the Kirkpatrick/Phillips model. According to Mumma and Thatcher (2009) , the entire notion of the Kirkpatrick/Phillips model may not truly measure the impact of the learning function on the enterprise, even under the most optimistic scenarios. It measures only the possible impact of isolated training events. Nagle (2002) reports a series of criticisms of the ROI calculation process such as: difficulty to have a valid measure, expensive process, complex process, process that can take up to one year, and presence of other factors that influence the performance of the organization. Concerning the methodological problems, McCain (2004) established a list of biases that could have an impact on the observed results which a training professional does not always think of. These include bias of a sample (selection of a non-representative sample or too small a sample), bias in the interviews, and bias in the presentation of questions.

4 DISCUSSION

Given that our objective is to respond to business needs concerning the management of training programs, this demonstration will be supported through comparison criteria based on the results of surveys conducted in the workplace by ASTD ic4p (ASTD, 2009) and others such as Formaeva (Formaeva, 2011). The criteria and their definitions are:

Efficiency. It is the criterion associated with an evaluation model, which refers to maximizing results while consuming a minimum of resources. An efficient model does not create any additional costs when calculating the training yield.

Usability. This criterion refers to the ease and the simplicity of using a model to evaluate a training program. The complexity involved in using a model is a barrier which can prevent companies from effectively evaluating their training program.

Implementation. Surveys have revealed that one of the barriers which can prevent companies from fully exploiting the existing models is the lack of IT tools. This assumes that a model which is implemented through an IT tool is more likely to be used by the companies and training professionals.

Diagnosis. This criterion refers to the ability of a model to identify the causes of the success or the failure of a training program. A model able to supply a diagnosis of a training program is a powerful decision-making tool.

Widespread. This criterion captures the fact that many companies use a model or that it is better known than another model.

The model of Kirkpatrick allows to evaluate the training at various levels of learnings integration. It also enjoys great recognition with the professionals of the training. Its main limitation is the fact that it does not explain in what a training is effective or ineffective (Holton, 1996; Saks and Haccoun, 2013). From a diagnostic standpoint, this evaluation model does not either indicate how to improve the training strategy used.

Besides, Saks and Burke (2012) were interested in the evaluation process by using the model with four levels of Kirkpatrick. Their research was conducted among 150 members of a Canadian association of training who work for organizations with between 500 and $1,000$ employees. The authors raise the following paradox (which is consistent with previous research): *enterprises measure more the reactions and the learnings, while only the behaviors and the results are positively related to a higher level of learnings transfer*.

The Kirkpatrick/Phillips model does not integrate the business analysis component. This analysis should be done before employees begin training. This fact is one major handicap to the success of the training evaluation and explains why enterprises cannot correctly and easily apply the Kirkpatrick/Phillips model (especially level 3). Indeed, the indicators used at level 4 of the Kirkpatrick model should be known during the management process, even before the first level of this model (Kirkpatrick/Phillips). This observation confirms the fact that the Kirkpatrick/Phillips model does not supply the required information for an analysis and adequate evaluation of the training.

Given that level 5 (added by Phillips) uses the data provided by level 4 of Kirkpatrick, it also inherits the gaps and weaknesses of the latter. Indeed, Kirkpatrick recommends using their model in hierarchical order (1, 2, 3, and 4). Consequently, given that the supplied data are not sufficient and (given the delay in coverage of the training management), the ROI process calculation (level 5 of Phillips) becomes complicated and useless due to lack of adequate data. Table 2, below, summarizes the comparison between our approach and the Kirkpatrick/Phillip model.

Finally, according to Rivard and Lauzier (2013), it's better to adopt a methodology which let you quickly fix a training strategy which does not give the wished results than ending up in a situation where we demonstrate that a training given to all employees is not ultimately effective. This point of view demonstrates the usefulness of AM2O and ETREOSys.

Table 2: Comparison table of our model to the Kirkpatrick / Phillips model.

	Efficiency	Usability	Implementation	Diagnosis	Widespread
Kirkpatrick/Phillips	No	No	No	No	Yes
Our approach	Yes	Yes	Yes	Yes	No

5 CONCLUSION

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 we extend the business process management systems by adding training management and evaluation functions (through ETREOSys).

Concerning the evaluation of enterprise training, we propose a more comprehensive approach for training project management, one that facilitates decision-making and the calculation of the tangible and intangible profits.

Relating to the problems raised in the literature, we reduce the biases and additional costs associated with training yield calculation. Indeed, we tie the training objectives and strategies to the performance wish list of the enterprise in the training design. Hence, from the beginning, the enterprise would be able to connect the expected outcomes with certain indicators used in the current functioning of the enterprise. When financial yield evaluation is required, our approach enables companies, to supply data from the quantitative indicators which will show the evolution of productivity and translate them into economic value without incurring additional costs. They could also use the qualitative indicators to demonstrate the social yield of training.

Finally, our approach ensures that training activities are aligned with business needs and allows the ROI (or ROE) calculation to be made without additional investment.

REFERENCES

ASTD (2009). *The Value of Evaluation: Making Training Evaluations More Effective*. ASTD Press.

Formaeva (2011). Synthèse d'étude: Les pratiques d'évaluation des formations des entreprises françaises en 2011. Technical report, Formaeva. Formaeva: Évaluer pour Mieux Former.

Holton, E. F. (1996). The flawed four-level evaluation model. *Human Resource Development Quarterly*, 7(1):5–21.

IIBA (2009). *A guide to the Business Analysis Body of Knowledge (BABOK guide), version 2.0*. International Institute of Business Analysis.

Kirkpatrick, D. L. and Kirkpatrick, J. D. (2006). *Evaluating Training Programs: The Four Levels (3rd Edition)*. Berrett-Koehler Publishers, 3rd edition.

McCain, D. (2004). *Evaluation basics*. ASTD, 1st edition.

Mumma, S. and Thatcher, C. (2009). The learning profit chain "connecting learning investments to financial performance". *Corporate University Xchange*.

Nagle, B. (2002). Roi gives a way to roe. *Candian HR Reporter,*, 15(13):7.

Phillips, J. J. and Phillips, P. P. (2003). Using action plans to measure roi. *Performance Improvement*, 42(1):24–33.

Rivard, P. and Lauzier, M. (2013). *La gestion de la formation et du développement des ressources humaines: Pour préserver et accroître le capital compétence de l'organisation*. 2e edition.

Saks, A. M. and Burke, L. A. (2012). An investigation into the relationship between training evaluation and the transfer of training. *International Journal of Training and Development*, 16(2):118–127.

Saks, A. M. and Haccoun, R. R. (2013). *Managing Performance through Training and Development*. Nelson Education, 6th edition.

Soliman, M. (2008). The use of dupont analysis by market participants. *The Accounting Review*, 83(3):823–853.

Touré, F., Baïna, K., and Benali, K. (2008). An efficient algorithm for workflow graph structural verification. In Meersman, R. and Tari, Z., editors, *OTM Conferences (1)*, volume 5331 of *Lecture Notes in Computer Science*, pages 392–408. Springer.

van Eerde, W., Simon Tang, K., and Talbot, G. (2008). The mediating role of training utility in the relationship between training needs assessment and organizational effectiveness. *The International Journal of Human Resource Management*, 19(1):63–73.