«ΣΠΟΥΔΑ1», Τόμος 55, Τεύχος 1ο, (2005) / «SPOUDA1», Vol. 55, No 1, (2005), University of Piraeus, pp. 47-73

CONSTRUCTING 'DATA ENVELOPMENT ANALYSIS' PERFORMANCE MEASURES: A CASE STUDY FROM THE GREEK PUBLIC SECTOR

by

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Abstract

Rapid changes in life-long training and performance measurement are posing serious questions to the work environment of public sector managers to undergo fundamental changes. Consequently, a Balanced Scorecard framework is attempted to increase the value of taxpayers' money and provide accountability of decision makers' contribution.

A field research of 14 directors of Decision Making Units with their civil servants trained at the state training center of the Greek Ministry of Economy and Finance, constructs the 'Data Envelopment Analysis' via a modified Balance Scorecard (BSC). This paper illustrates empirical evidence on few selective key performance indicators, which finally measure the performance of public training programs (JEL Classification: M49).

Keywords: Management Accounting, Balanced Scorecard, Performance Measurement, Data Envelopment Analysis, Life-Long Training and Public Sector

1. Introduction

With regards to the preparatory phase, the relevant research inspiration was derived both from literature and practice and was focused on this research problem that is both practically relevant and theoretically challenging *(Labro & Tuomela, 2003).*

Performance measurement depends ultimately on defining first what is performance, and then what is measurement; *Henderson (1990),* has found it useful to conceptualize the process (cost-resources-outputs-outcomes) in the public services, which distinguishes costs, resources provided, outputs and outcomes. While output measures the use made of resources, outcome reflects the ultimate value or benefit of services to its users. These measures take form as

performance indicators, which can be monitored over time or compared with targets or with performance elsewhere. There are 3 kinds of traditional measures (better known as the 3 Es)

- **Economy measures** showing the cost of acquiring resources such as staff, premises or supplies.

- **Efficiency measures** demonstrating the outputs achieved in relation to the resource inputs (i.e. the cost per residential place). Where the service facility can be measured, it is also possible to measure its utilization, (i.e. the occupancy of residential training rooms) or the utilization of recreation facilities.

- **Effectiveness measures** providing the final outcome of the service in relation to its output, (i.e. the number of trainees passing an examination as a percentage of all the trainees in the organisational group).

It is important for public administration to define and measure the target population for each public service they offer. This provides the basis for the first two performance indicators (Es). The first measures the level of service (focusing for example on the relationship between cost of resources and resources for adequate training) while the second shows the take-up of services (focusing for example on the relationship between the input of resources and intermediate outputs achieved in a target population of organizational context).

1.1 Research Problem

The research problem can be considered as performance measurement problem into case organizations as an adequate basis for making constructive research (see *Kasanen et al, 1993; Tuomela, 2003; Labro & Tuomela, 2003).* The goal for this research is to construct a consistent performance measurement framework that would support effective strategic management and would assist in strengthening customer thinking and ways of operating at the case organization. In *Tuomela's (2003)* study, the fact that the Customer Scorecard was never implemented resulted in the refining of the theory of performance measurement and customer focus. If the model had been presented without any implementation effort, the results would have been incomplete or even misleading. This paper demonstrates that the improvement of application in performance measurement can be combined with theoretical development in a credible manner within a single study *(Ittner & Lacker, 1998a);* if the research process is handled with care *(Labro and Tuoemela, 2003).* However, the con-

structive work for public organizations remains highly unexplored (see *Chang & Chow 1999, Vasilakis, Paggios and Papadeas 2004).*

1.2 Research Objectives

The rational is to reduce the knowledge gap between Management Accounting's (MA) theory and practice. Getting a better insight into the appropriateness of the paper objectives, life-long training is one of the central elements of performance improvement, into organizations in general and public organizations more specifically *(Hause, 1972; Griliches & Mason, 1972; Cascio, 2000; Williams, 2002).* Furthermore, performance measurement in governmental organizations intends to hold public managers more accountable for their results in terms of outputs and outcomes *(Foltin, 1999).* Life-long training takes place due to different factors, but in the reality of governmental institutions the political influence seems to be the main source *{Chang & Chow, 1999).* Many theoretical approaches exist on efficiency improvement after the training period *{Hause, 1972; Griliches & Mason, 1972; Hedges and Moss, 1996; Chang & Chow, 1999),* however, there is not any empirical evidence on the performance gains of life-long training taking into consideration the training costs. Training costs are categorized as direct and indirect costs. Direct costs include running the training program, while indirect costs include employees' absence from their duties during the training period.

A constructive case study research could help us to close the knowledge gap between Management Accounting's (MA) theories and practice *{Yin 1994, Labro and Tuomela 2003).* The selective case organization that applies to the above case study objectives is the public sector training center of the Greek ministry of Economy and Finance. That training center provides life-long education to all civil servants for its mother ministry *{SEYYO, 2003).* It is obvious that departments that have to cope with high level of life-long training should be more competitive departments *{SEYYO, 2003, Vasilakis, Paggios and Papadeas 2004).* Although a remark has to be made that these departmental changes are also influenced from the central government's wish for change. This paper analyzes the measurement problems in public training programs by changing trainee focus with customer focus (as is the case in mainstream BSC case studies). From a theoretical point of view, this study represents a practical 'test' of strategic integrated performance measurement systems that have been called upon to facilitate long-term financial excellence (e.g. *Kaplan & Norton 2001a, 2001b).*

The study is using a combination of methodologies to provide empirical contribution to performance measurement problems. However, this contribution is restricted to Data Envelopment Analysis (DEA), which tries to clarify the ambiguous and speculative relationship of trainee's unit relative performance immediately after the training process. In the next section, a case study research approach is presented aiming to apply the Balance Scorecard's (BSC) framework in order to interpret a solution of the research problem and answer the research questions. The successful implementation effort of the BSC *(Kaplan & Norton 2001, 2001a)* for public services led to the consideration of the theoretical underpinnings and critical evaluation of the development process *(Chang & Chow, 1999).* Furthermore, the empirical findings are going to be analyzed via DEA, after suited the applied theoretical framework in the case organisation. The concluding remarks can test the understanding of how applied BSC can increase public training centers' performance via monitoring its trainee DMUs and what forces shape the accountability of those training processes. Finally, the most efficient DMUs (called as frontier) could be used as reference to trainee centers and directors of DMUs for their own performance improvements.

1.3 Research limitations

The practice of performance measurement in public services is not always as easy as theory. The most obvious difficulty lies in trying to measure the 'outcome' or effectiveness of a service, given that it is usually easier to measure its 'output' *(Henderson 1990)* than its input. But output measures may be misleading or meaningless unless there is reasonable assurance about the effectiveness and quality of the service. The easiest things to measure are usually inputs. But this embeds its own danger - the measurable drives out the un-measurable, and performance review is based towards reducing or, increasing cost rather than improving effectiveness. Consequently, combining the pursuit of trainee focus and the construction of new strategic efficiency (input-output) measurement systems (excluding effectiveness due to limitations of data availability and measurement) should result in organizational success *(Chang & Chow 1999).* New insights into the nature and extent of the benefits and obstacles of such integration (efforts) are targeted by *Kaplan & Norton (2001, 2001a).*

Due to lack of data availability in Greek public sector this research is somewhat limited in term of generalization. The allocation of public resources is incremental through policy reviews. The input-based public service rigidities pay little attention to budgetary processes, to economic and social benefit of public

expenditure and provide little (or no) attention to performance. Many budgetary amendments take place in-year allowing the Minister to have wide powers and the accountability of Minister and officials to be focused on legality rather than on contemporary financial management and performance. There is a heavy process for 'control' with many groups of controllers, auditors and inspectors. There are not any systems of audit and the ex-post audit is confined to legality checks. Finally, the old accounting, management information, statistical coding, payments and IT systems restrict and limit the data analysis to selective input and output indicators.

1.4 The Significance of this Research

Budgeting of public sector training programs needs specialized performance objectives for public money spending, in order to clarify what expenditure is related to output-services of trainees and therefore an open way for improving public services management (Chang & Chow, 1999). Performance indicators create flexibility in order to re-allocate resources within training programs (especially concerning staff) and creates new reporting terms of public service employment in order to enable better internal management, including the ability to move staff from low value areas and to recruit and promote able staff *(Foltin, 1999).* In the case of Greece separate DMUs' budgets have been found (or running costs budgets) to be an invaluable tool for reducing administrative costs and liberating resources for services delivery. Therefore, the administration budgets cover full costs of employing, accommodating and equipping civil servants. Each public organization needs flexibility to redeploy expenditure within these budgets so as to maximize relative efficiency of each DMU *(Vasilakis, Paggios and Papadeas 2004).* Performance measurement indicators (cost of resources inputs and efficiency of outputs) contribute another dimension of public accountability for funding management both to the taxpayers and to European Union (EU) in general and to the mother ministry organization more specifically *(Foltin, 1999; SEYYO, 2003).* The BSC can be used as a report card from which taxpayers and EU can gauge operational efficiency (inputs-outputs) of each state training center and measure the Value for these spending funding' *(Chang & Chow 1999).* Finally, the successful implementation of the performance measures through the BSC could provide proof of the relative efficiency of 14 DMUs despite the obstacles and resistance from the organization culture of the Hellenic public sector.

1.5 Research Questions

In this paper two variables seem to play a central role in evaluating public training programmes a) the cost of training provisions and b) intermediate organizational output after training (called training efficiency). Even though relatively few studies refer to the performance gains from starting level training such as colleges and universities *(Hause 1972, Griliches & Mason 1972, Chang & Chow 1999),* these terms have not been clearly identified and operationalized for state life-long training programs. Using the term approach to describe the application of BSC in a public training center means an effort to organize various activities in links and building processes. The study started in a rather unstructured manner. The initial empirical findings guided the researcher in the search of potential research questions.

- The first research question considers identifying and operationalizing possible terms for life- long training in the public sector. *Research question 1 (RQ1): How can the terms economy (cost and resources inputs of training provision) and efficiency (inputs of resources and outputs after training) be operationalised for quality indicators.*

- The statement of the first question leads to a second *Research question (RQ2): Whether greater training in fact leads to relative efficiency improvements in all DMUs.* However, political intervening as a variable in public sector training programs is expected. Especially at governmental organizations this could be an important factor, because of the internal political environment of these organizations.

- *Therefore, the third Research question (RQ3) is: What is the relative efficiency on intermediate outputs level of training provision.*

2. Review of the Literature

Management Accounting (MA) entered in a new stage in the mid-90s, with focus on planning, control and waste reduction; expanding to encompass a more strategic emphasis on the creation of firm value through the identification, performance measurement, and management of the drivers of customer value, organizational innovation, and shareholder returns *(Ittner & Lacker, 2001).* A hallmark of this era is the introduction of a diverse set of 'new' MA techniques that include the development of balanced scorecards of leading and lagging indicators of economic success (look at *Kaplan & Norton, 1996).* The implementation of complex measurement systems is likely to be quite costly

and even limited evidence on economic benefits of these systems is still scarce. The number of studies in the field of strategic performance measurement is still very limited.

Apart from the *Kaplan and Norton* papers, the existing literature on BSC could be divided into two main categories. The first stream search has focused on the BSC as a new management system. Some researchers have debated the relevance of the concept. Questioning whether the concept is new or whether BSC had any theoretical substance, academics have critically investigated the basic assumptions of the scorecard (see *Epstein & Manzoni 1997, 1998 and Norreklit, 2000)*. Others have emphasized on the potentials of the BSC, arguing for more research on the concept. In the researcher's view, BSC is among the most significant developments in management accounting and, thus, deserves intense research attention *(Atkinson et al, 1997)*. Ignoring the fact that the model might have some theoretical weaknesses *(Ittner & Lacker 1998a, 1998b, 2001)* and that the basic ideas might have been present elsewhere, this study focuses on the second line of research, namely how the scorecard is put to work. This means that the paper tries to capture how BSC has been used in practice (Kaplan and Norton 1997).

Researchers have studied how organizations that had actually adopted the concept developed and used a scorecard within the public organization (see *Tuomela 2001, Chang et al 2002, Lopez & Miranda 2002, Ellwood & Rixon 2003, Tuomela 2003, Carmona & Gronlund 2003, Pollalis Y., Gartenberg M and Edmunds B. 2004)*. This line of research contains normative studies, action-based studies and studies that are more descriptive in nature. However, most of the research done in the latter category has focused on the structural or technical aspects of the scorecard. Following the tendencies of research implementation on new knowledge, the aim of the scorecard studies seems to be to report on the more formal or technical aspects of the concept *{Ittner & Lacker, 1998b)*. Moreover, there is a substantial amount of research concerning how organizations have linked their strategy to day-to-day activities and how the four perspectives of the scorecard are displayed in an organizational scorecard (see *Govidarajan & Gupta, 1985; Eccles, 1991; Ittner & Lacker, 1997)*. Many studies highlight how the perspectives are linked together, which measures are used, how they relate to the strategy in use or how the management process is or can be improved by the scorecard *(Ittner and Lacker 1998a, 1998b, 2001, Tuomela 2001, 2003, Lopez & Miranda 2002, Pollalis Y., Gartenberg M and Edmunds B., 2004)*.

Another more specified, neglected and to some extent related area in MA research seems to be 'the customer' and its interaction with MA. *Foster & Gupta (1994),* for instance, state that the combination of marketing, cost management and MA is very important for many companies as demands for organizations to become customer focused has risen *(Hemmer, 1996; Tuomela, 1997, 2001, 2003; Ittner & Lacker, 1998a).* Still quite few researchers have considered these issues simultaneously to other issues *{Foster & Young, 1997).* The work of *Vaivio (1999a, 1999b)* is a notable exception to this respect. His descriptive and explanatory studies of the adoption of non-financial measures of customer relationships make a significant contribution to this particular area of MA research. Yet, his research is limited to an ex post analysis of the critical events of introducing and using customer-related non-financial measures *(Ittner & Lacker, 1998a).*

In managing change, the literature stresses that training activity is of utmost importance in order to make organizational change successful *(Hause, 1972; Griliches & Mason, 1972; Hedges and Moss, 1996; Chang & Chow, 1999; Cascio, 2000; Williams, 2002).* In *Kaplan and Norton's* work, training-activities, or important roles, have been stressed in terms of the architect, the change-agent and the communicator. In the current study, an effort is made to go beyond the more general statements, such as 'top management support is necessary for successful implementation', and try to validate how training can actually shape character and output of the organizational process *(Chang & Chow, 1999; Cascio, 2000; Williams, 2002).*

3. Case Study Research Approach

Using a traditional case study research design *(Yin, 1994: p. 20)* the research has structured the initial findings around 'how' and 'why-questions' *(Silverman, 1999).* In this part of the study, the literature on BSC has used *(Chang & Chow, 1999; Kaplan & Norton, 2001, 2001a),* organizational change and training to apply a theoretical framework within which to make propositions and interpret the case findings. This case study set out to discover whether, operating costs could be reduced in a cost-effective manner as a result of specific training outputs and financial inputs. The investigated parameters were operating costs (in terms of teaching rooms, timetable, breaks, secretarial support, hospitality, the teaching material etc.), and selective efficiency driver's attitudes. This organizational case study has two objectives:

1. To adequately operationalise the terms economy (cost and resources inputs of training provision) and efficiency to (inputs of resources and outputs after training) be operationalised for public sector managers of DMUs.

2. To get a first insight into the relationship between these terms, and apply a theoretical framework based on these insights.

The case study evidence was collected, firstly by direct and participant observation, archival records and secondary data analysis, secondly by taking unstructured and informal interviews from key personnel (trainers & trainees) and thirdly by sending questionnaires to all trainees. This triangulation and the multi-approach of case study data collection methodology were vital for a clear, more complete, holistic and contextual portrait for a proposed theoretical framework based on collected, assessed and validated data *(Yin, 1994; Silverman, 1999; Ryan et al, 2002).*

Direct observation includes observations of staff meetings. Direct observation reveals many aspects of the context and gives real time data *(Yin, 1994; Silverman, 1999).* The observation tries to identify whether there is a potential marriage between BSC on each training programs area. During some professional meetings, the researcher tried to be a passive observer, taking notes and trying to understand their work within their natural context. In a few cases, the researcher was asked to reflect upon a certain issue or comment on what it was observed. In the case of the steering group we have also presented and discussed the research project and received comments on the preliminary findings *(Vasilakis, Paggios and Papadeas 2004).*

Another important source of evidence was documents and archival analysis. The advantage of documentation is in time availability and the fact that it records the real time events, while informal interviews may be flawed by time and subjective perceptions. Its disadvantages include a degree of irretrievability or bias, and its inability to give a full account of events described *(Yin, 1994).* Documents provide 'facts' *(Pettigrew, 1995),* but on the other hand it is rare that decision-making can be fully depicted on paper *(Mintzberg & Waters, 1990).* Documentary data were reviewed offering insight into the Training Center decision process. Documentation that was reviewed included internal reports, communications, business plans, letters, memos, organizational charts etc.

A selected number of individuals were interviewed informally, ranging from the Managing Director of the training center to civil servants at unit-training area level. Some of the early interviews were rather open-ended,

semi-structured or unstructured (for definitions look at *Yin, 1994)* and aimed at getting the individuals view on the research project, their work on unit-level and provide useful details such as personal view, feelings, interpretations etc. In a later phase, the interviews were more focused on research questions (again look at *Yin, 1994; Pettigrew, 1995),* around different aspects of the implementation process and decision makers' potential impact on that process. During the interviews, the researcher took notes and did not use a tape recorder, because no one was willing to speak freely while being recorded.

4. Theoretical Framework: BSC Methodology

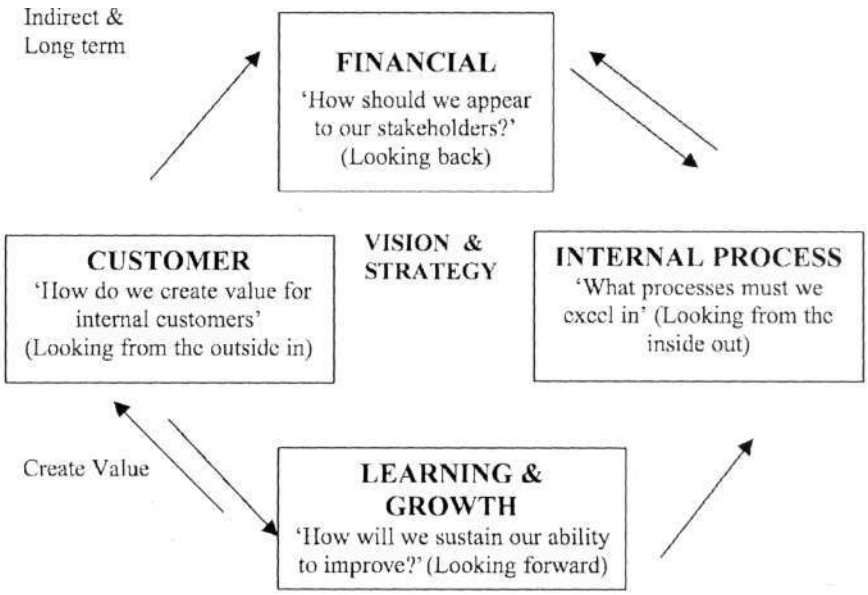
Case studies are characterized as small samples but their actual role is to make theoretical rather than the statistical generalizations *(Scapens, 1990).* Theoretical generalizations mean that a case study as a research method uses theory to explain some observations. The theory of BSC is either sustained or applied from the empirical results *(Kaplan & Norton 1997).* The distinction between statistical and theoretical generalization adds to the variation between exploratory and explanatory case studies. Statistical generalizations may fail to fully explain individual cases, but do provide laws' of general applicability. On the other hand, explanatory case studies use theoretical frameworks that allow the studied subject to be viewed within the broader context it takes place. This approach is holistic and allows for the better explanation of social phenomena *(Scapens, 1990).* Case studies infer patterns that may provide explanations and better understanding into particular events, but are generally unsuited to making generalized predictions. Explanation- building is a special part of the pattern-matching activity, using theoretical propositions to explain case study findings. With the use of case study evidence, theory is either confirmed or modified *(Scapens, 1990; Yin, 1994; Pettigrew, 1995).*

Kaplan & Norton introduced a concept called The Balanced Scorecard'. Since then, their concept has received a lot of attention among academics and practitioners alike. Focusing initially on the use of financial measures to manage organizations, *Kaplan and Norton (1992)* proposed a new concept where traditional financial measures were complemented with non-financial measures in a BSC through qualitative performance indicators. In papers that followed, Kaplan and Norton developed the scorecard to be more than just a measurement system, starting out with the article on implementation of the BSC in 1993. In their articles from 1996 onwards the scorecard became a strategic management system, so as to link long-term strategic objectives with day-to-day activities. Linking the strategy to measures on the scorecard was

emphasized as the use of scorecards for strategic learning and even strategy application *(Kaplan & Norton, 1996a, 1996b, 1996c)* was generalized. 'We consider the feedback and learning process to be the most innovate and most important aspect of the entire Balanced Scorecard management process.' *(Kaplan & Norton, 1996c: p. 18)*.

FIGURE 1

The Balance Scorecard (BSC)



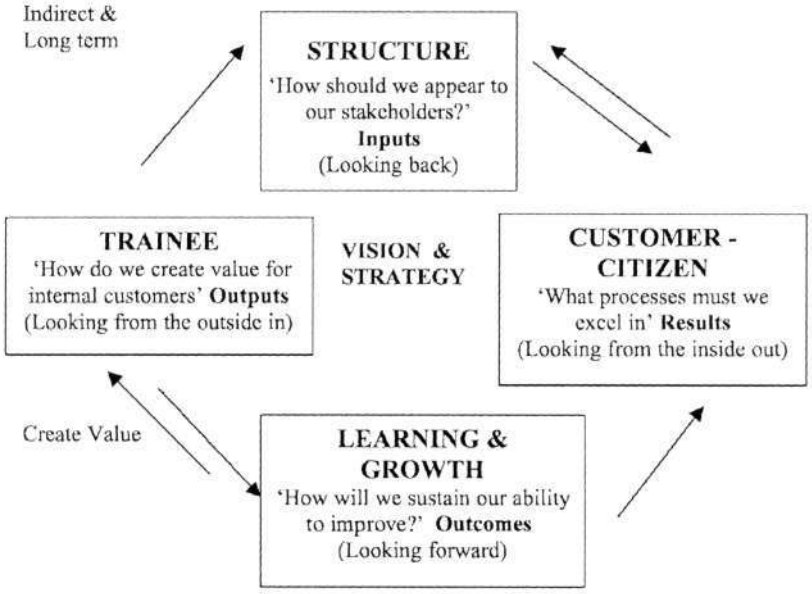
(Source: Kaplan, R S and Norton, D P (1996a), "Using the balanced scorecard as a strategic management system", Harvard Business Review, January-February, pp 75-85)

Balanced Scorecard (BSC) is a theoretical framework of translating an organization's vision and strategy into groups of cause and effect linking performance drivers and outputs. The central theme of BSC is its focus on goal and collaborative determination of these goals and their measures. The aims of BSC combined with life-long training in Greece motivate the modification and applicability of this framework for the selective public training center. The content of BSC was mainly determined by newly established strategy documents and developed by the researcher with continuous feedback from the case organization (see the following figure). Such demonstrable cause-and-effect rela-

tionships provide a conceptual framework for selecting meaningful inputs and outputs for DEA (Data Envelopment Analysis).

FIGURE 2:

The Balance Scorecard (BSC) of the Training Center



(Source: Vasilakis, Paggios and Papadeas (2004), 'Constructing Data Envelopment Analysis Via Performance Measures: A Field Research from Modifying the Balanced Scorecard in a Public Training Center', Presented Paper & Prize of Best Ph.D. Presentation, *4th International DEA Symposium*, 5-6 September, Birmingham)

For many years Management Accounting (MA) has developed implicit theories of BSC but the lack of explicitness has prevented MA from describing and testing these theories. As a consequence, before embarking on theory testing by field researches (see *Atkinson & Shaffir*, 1998; *Young*, 1999; *Dunk*, 2003), the researchers are obliged to modify or apply the theoretical framework with critical success factors of Key Performance Indicators (KPIs). BSC has the advantage of providing a comprehensive map of strategic outputs and outcomes for each Decision Making Unit (DMU) thus associating performance drivers and value propositions.

The empirical testing of the modified BSC application took place by field research. MA provides information intended to influence the behaviour of individuals. Therefore, field research in MA invariably focuses on how people, either acting individually or in groups, react either to MA information (such as cost or productivity data), or MA systems (such as control or planning systems), (Atkinson et al 1997).

In this study three of the four BSC perspectives are softly modified 1) the structure perspective shifts with financial, 2) trainee with customer perspective and 3) internal process with customer-citizen perspective. The modification took place in order to apply BSC to DMUs. These are the ministry directories of the field research.

4.1 Structure Perspective instead of Financial

The financial perspective drives the other three perspectives. Traditionally, the annual budgeting illustrates the details of short term in first perspective of BSC (financial data: direct and indirect cost per trainee for each training program). However, many selective quality cost indicators are illustrated to other three perspectives. Finally, this perspective is softly modified to structure perspective in order to illustrate more effectively the case organization.

4.2 Trainee Perspective instead of Customer

The applied BSC theoretical framework consists of changing the customers (as used by theory) for trainees. Although the trainee could be construed as a customer, his characteristics are quite different. This paper's motives are different and therefore there exists a need to operationalise with different KPI to cater for the specific customer, the trainee. The other three perspectives also need application to a degree and many indicators (I) have been identified. Trainee value propositions, i.e. those performance dimensions that are expected to have the largest impact on trainee value added, are the KPI of the differentiation strategy. The first part in the chain (Figure 2 BSC of training center) is derived from the fact that particular internal factors are crucial contributors to the degree of success in these KPI. Consequently, trainee satisfaction is believed to depend mostly on the KPI. Higher degree of trainee satisfaction is then expected to lead into behaviors like increased co-operation and additional performance improvement that should finally improve financial performance *(Chang & Chow, 1999).*

4.3 Customer-Citizen Perspective instead of Internal Process

The aim is to identify those processes (new or existing) that will enable the training centre to deliver on the value propositions for running training programs of targeted customer-citizens that serve the trainees and therefore adopt some selective KPIs. In addition, while customer information (and in this organization's case trainee information) was typically the domain of marketing. Strategic performance measurement systems like BSC can shift at least some parts of the generation and dissemination of customer information to other professionals like management accountants *(Hemmer, 1996; Tuomela, 1997, 2001, 2003; Ittner& Lacker, 1998a, 2001).* Competition of the ownership of customer related information may induce difficult power struggles as indicated by *Vaivio (1999a).*

4.4 Learning and Growth

The 'learning and growth' perspective is designed to focus the attention of civil servants and trainees on how to affect the training program processes after training and therefore adopt some selective KPIs. Even though process performance should have a direct impact on efficiency (e.g. performance of process) and to growth (development of new training programs to all ministry areas), trainees play the most crucial role in turning core elements of internal operational performance into performance growth.

5. The merger of BSC with DEA

Since 1966, *Zlatkovich et al* had stated, that the definition of accounting *'is the process of identifying, measuring and communicating economic information to permit informed judgments and decisions by users of the information'. Dean* (1997) observes that the above definition leaves plenty of room for the application of mathematical techniques within accounting. However, the practice of accounting limits itself to numbers, as opposed to equations and coordinate systems.

In order to materialize this evolvement, an attempt is made to bring together a measurement method, BSC and a liner programming method, DEA. *Chames et al* (1978), states that DEA can be applied when an analyst intends to measure relative efficiency of comparable DMUs, which can be separate institutions, e.g. Ministry Directories.

Tomkins and Green (1988) have defined the conditions under which DEA is useful for the decision makers. 'If *the technique yields additional insights and helps evaluators to sharpen their focus of enquiry and debate, DEA is useful'*. If our evaluators are to be credible, they must be able to present reasoned methods for handling the multidimensional nature of the evaluation problem, which DEA highlights so well. Whether DEA is useful will depend to a large extent on the structure of the decision situation in which it is used - plausible number of variables, reliability of measurement, etc.

5.1 Borrowing Metrics from BSC

The development of BSC measures was not based on statistical analyses of cause and effect relationships but on the intuition of practical experience *(Papadeas and Paggios 2003)* and sound theoretical knowledge *(Chang & Chow, 1999; Kaplan & Norton, 2001, 2001a).* While the researcher played the most crucial role in the development work, internal documents (e.g. strategy and management papers, and reports on functional and efficiency center measures) were extensively exploited (Vasilakis, Paggios and Papadeas 2004). The researcher also consulted with ministerial scientists and experts about measures relating to internal processes, core elements and research & development. With regard to those financial measures that are reported to the mother ministry organisation and EU management authority funding of the training center it was decided that calculation rules would be applied. The researcher had to get further support from top management officials for an application of the BSCs theoretical framework. In the application case, it seems that giving information is a secondary activity rather than influencing the decision makers as primary activity. To apply an organisation-wide framework firm political decision is vital. Hence, influencing the politicians is of great importance. From the researcher's point of view it seems that the politicians were only partially informed of the framework and the potential consequences of the decision.

BSC generates a large quantity of data about operations. DEA can help focus MAs attention on areas of specific interest by enabling simultaneous multiple input /output /results /outcomes analysis. The choice of input, output, results, and outcomes variables for the DEA model is crucial. Results may vary according to the variables chosen. Two researchers may obtain different results depending on the choice of variables. Therefore, extreme care must be exercised in selecting the variables (obviously, such a choice would depend on the objectives of the analysis).

While, the theoretical framework contents four perspectives, the design of the questionnaire was structured in a more simplistic way in order to be convenient to respondents. Each section contained items that asked responses on a 4-point Likert scale (Likert scale was quantified in 4 ranks 0,1,2,3 or 0, -1, -2, -3 in order to measure the relative performance through the quality performance indicators), followed by open-closed questions. For item, responses were sought relating to the time of the field research (December 2003) and three years previous (2001). Choice of the 3-year time span was based on existing findings that such a time window is needed to capture changes in organizational systems and practices *(Chenhall,* 1997).

There were four input, six output, and four results, five outcomes variables identified during the data collection stage (see tables 1, 2, 3, 4). Data on these variables were quantified and collected in 2003. The final variable chosen from among the initial identified set is based on the consideration of parity in the units of measurement of the variable and to ensure uniqueness in the representation.

TABLE 1

Selective Key Performance Indicators (KPIs)

	Structure Perspective		*Customer / Citizen Perspective*
S1	Number of Trained employees	C1	Time reduction to citizens
S2	Number of participating training programmes of your directory.	C2	Citizen satisfaction improvement
S3	Motivated Civil servants for training	C3	Cost reduction for citizens
S4	De-motivated Civil Servant for training	C4	Financial authorities trusted by citizens
	Trainee Service' Perspective		*Learning & Growth Perspective*
T1	Successfully completed aims	L1	Coverage of training needs
T2	Better reallocation of duties	L2	Appropriate training needs identification
T3	Cost reduction of directory processes	L3	Assimilate reduction of hired civil servants
T4	Time saving of directory processes	L4	Improvement of working conditions
T5	Productivity improvement of directory	L5	Develop modern technology
T6	Modernisation of directory		

DEA studies can take advantage of the many metrics used in BSC. Metrics should be quantifiable, complete and controllable *(Avkiran,* 2002). A qualitatively oriented approach to research contrasts with a positivist approach, which searches for cause through methods such as questionnaires and inventories that yield data amenable to statistical analysis. However, qualitative methodology is more than a set of data-gathering techniques; it is a way of approaching the empirical world *(Atkinson & Shaffir,* 1998).

6· DEA for Decision Making Units

In DEA models the most efficient directories are identified and assigned a value (score) of unity to it. The directories that are found to be less efficient are assigned scores between zero and one and the more efficient are assigned scores between two and three. The structure perspective has input indicators that are assigned negative values. Thus DEA does not measure optimal efficiency of directories. Instead, it differentiates the least efficient directories from among the set of all directories.

DEA has gained more acceptability in recent years for evaluation and measurement of relative efficiency of any type of input and output systems, organisations, educational institutions, industrial organisations etc., have provided quality data. *Papadeas, Paggios and Vasilakis* (2002), applied DEA's approach to measure the relative efficiency in starting education like in the case of Greek Universities.

In this paper DEA analysis approach of life-long education was carried out in three stages. At the first stage the model was considered to quantify the relative efficiency of directories in the form of each BSC's perspective. In the second stage the model considered the form of total weight of four BSC perspectives (total weight inputs by total weighted outputs, results, outcomes). In the third stage a DEA frontier is considered that consists with the best practice units (directories). Therefore, *'the main result is the relative efficiency of each unit measurement against the best-practice units similar to if (Paradi,* 2002: p.19).

Finally, a questionnaire designed to collect data was prepared and filled *(Scapens, 1990; Ryan et al, 2002).* The aim of the questionnaire was to get comments at the end of the training program by trainees' directors. The questionnaire was constructed in a simplistic way in order to be convenient to respondents and consisted of selective quality indicators based on theoretical framework perspectives. It was prepared based on trainees' attitude about training

experience in order to fill to some extend the gap between empirical and theoretical knowledge of MA.

6.1 Results and Analysis

The intensive and time-consuming nature of field research invariably results in small sample sizes *(Dunk,* 2003). People with backgrounds in the scientific method, which focuses on theory confirmation, believe that field research is ill, suited to theory testing *(Young,* 1999). Consequently, researchers such as *Yin* (1994) argue that it is more appropriate to use field research to develop respectable and believable working theories and then use other tools, such as archival research, surveys, or experiment to test these constructs. A questionnaire was design based on BSC methodology and according to field research organisation records; civil servants from 211 different Ministry's directories (DMUs) were trained during the year 2003. A sample of 20% could be considered as adequate and therefore 45 directories were selected as sample based on the amount of training. A survey of posted questionnaires to 45 directors of DMUs at the Hellenic Ministry of Finance & Economy took place. Finally, only 14 directors responded (31% of the sample).

Four selected structure (inputs) Key Performance Indicators are adjusted negatively only for the first perspective (Structure) of BSC. The first input indicator (S1) contains the sum of total number of trainees for each DMU for 3 years (2001+2002+2003) divided by the number of civil servants in the directory in 2003. The second indicator (S2) contains the number of training programmes that the civil servants of the directory have participated in the last 3 years (2001+2002+2003). The third indicator (S3) illustrates positively the motivation for participating to training programmes of directory civil servants (none=0, few=l, enough= 2, many=3). The fourth indicator (S4) illustrates negatively the de-motivation for participating to training programmes of directory civil servants (none=0, few= -1, enough= -2, many= -3).

TABLE 2

Key Performance Indicators ranks (KPIs)

Structure Perspective							**Trainee's Service Perspective**								
DMU	*S1*	52	53	*S4*	SUM	*Rank*	*DMU*	77	*T2*	*T3*	Γ4	Γ5	T6	*Sum*	*Rank*
1	0	4	1	-1	4,27	3	1	2	*2*	*2*	2	2	2	12	5
2	0	16	2	-1	17,4	11	2	3	*2*	3	3	2	3	16	1
3	1	8	3	0	11,6	9	3	2	0	2	2	2	2	10	11
4	1	17	2	-1	18,7	12	4	2	3	2	3	3	3	16	1
5	1	20	2	-1	22	13	5	2	2	2	2	2	2	12	5
6	0	11	2	-1	12,4	10	6	2	2	2	2	2	2	12	5
7	1	3	2	-1	4,5	4	7	2	2	0	2	3	3	12	5
8	2	32	1	-1	33,6	14	8	2	2	2	2	2	2	12	5
9	4	2	0	0	6	5	9	2	2	1	1	1	1	8	13
10	2	7	3	0	11,5	8	10	2	3	2	2	2	3	14	3
11	2	9	0	0	11	7	11	0	3	0	2	2	2	9	12
12	0	4	3	-1	6,31	6	12	3	3	2	3	0	3	14	3
13	1	3	1	-1	3,67	2	13	2	2	2	2	2	2	12	5
14	0	3	1	-2	2,41	1	14	1	1	0	0	1	2	5	14
Customer/Citizen Perspective							**Learning & Growth Perspective**								
DMU	*C1*	C2	*C3*	*C4*	*SUM*	*Rank*	*DMU*	*L1*	*L2*	*L3*	L4	L5		*Sum*	*Rank*
1	*2*	2	1	1	6	9	1	1	1	1	2	2		7	14
2	3	2	2	3	10	2	2	2	2	3	0	3		10	7
3	2	3	3	3	11	14	3	2	2	3	2	2		11	3
4	2	3	2	3	10	2	4	3	2	2	3	2		12	1
5	2	2	2	2	8	6	5	3	2	2	2	2		11	3
6	2	2	2	2	8	6	6	2	2	2	2	2		10	7
7	2	2	0	2	6	9	7	3	2	0	2	2		9	12
8	2	2	2	0	6	9	8	3	2	2	2	2		11	3
9	1	1	2	2	6	9	9	2	2	2	2	2		10	7
10	2	3	2	3	10	2	10	2	2	2	3	2		11	3
11	2	2	2	1	7	8	11	2	2	1	2	2		9	12
12	3	3	3	3	12	1	12	2	1	3	3	3		12	1
13	2	2	2	3	9	5	13	2	2	3	1	2		10	7
14	2	2	0	2	6	9	14	2	2	2	2	2		10	7

The results of the selective Key Performance Indicators from trainee' service, customer/ citizen and Learning & Growth perspective of BSC are illustrated as follows. The Key performance indicators were quantified from the answers of directors, as: none=0, few=l, enough= 2, many=3. Therefore, the ranks of DMUs depend on the sum of quantified descriptive Key Performance Indicators.

In assessing and validating the results, theory plays an important role in internal validity test, which can be achieved using pattern- matching and explanation building *(Yin, 1994).* Internal validity is concerned mainly with explanatory case studies and is about making sense of the data collected. The external validity test is about generalizing from case studies. Generalization from case studies is theoretical and not statistical. Since case study research methods resemble experiments, external validity is sustained when a replication of the case study is feasible (Yin, 1994). Finally, reliability is the test that assures that if the case study were to be repeated, the researcher could have reached the same conclusions. For that reason it is necessary that the researcher record in documents the procedures followed during the field study *{Yin, 1994).*

6.2 Implementation of DEA

Examining the scope of the research problem solution's applicability a rich description of the organizational context and of the research process is made in order to provide convincing analysis. Descriptive case study research is important and widely used in MA *(Ryan et al, 2002).* Therefore, in discussing the findings of this paper it is useful to outline the different requirements of the various descriptive types of survey (questionnaire). DEA has a long lead-time before any benefits are realised *(Paradi, 2002).* DEA can assist as a tool for sensitivity analysis and reduce the burden of interactive application of BSC *(Avkiran, 2002).*

For the implementation of DEA, the BSC framework and methodology was used, adopting the radial improvement model (balance of four perspectives), under constant returns to scale and uniform priorities. The implementation included different indicators of each perspective, involving the assessment of DMUs relative significance rates and was organized as follows.

DEA allows each of the inputs/outputs to be measured in their respective units; i.e. the need for a common dominator such as money for all variables under consideration can be costed or converted into one unit of measurement - consider.

The merger of BSC with DEA enables relative performance measurement - benchmarking indicators along with a set of diagnostics for identifying problems and inefficiencies. These applied perspectives are 1st1y structure perspective, 2ndly trainee service perspective, 3ldly citizen/ customer perspective, 4th1y learning and growth perspective.

TABLE 3

DMUs Relative Performance

FINAL RANK	1	2	2	4	5	6	7	8	9	9	9	12	13	14
DMU	12	4	10	13	2	5	6	7	1	8	14	9	3	11
SCORE	2,75	4	4	4,75	5	6,8	7	7,5	7,75	7,75	7,75	8,5	9,25	9,75
PERSPECTIVE'S RANKINGS														
Structure	6	12	8	2	11	13	10	4	3	14	1	5	9	1
Trainee	3	1	3	5	1	5	5	5	5	5	14	13	11	14
Citizen	1	2	2	5	2	6	6	9	9	9	9	9	14	9
Learning	1	1	3	7	7	3	7	12	14	7	7	7	3	7

The limited number of DMUs and Score restricted the variance of analysis. The most inefficient directory (DMU No. 11) has a sum of 9,75 and divided by 2 (could be consider sufficient for our implementation) makes 4,875. Therefore, we consider a frontier less than a sum 4,875 and they are the 4 best practices ranked DMUs in the Hellenic Ministry of Economy and Finance. These four DMUs could create a frontier in order for the managers of the inefficient DMUs to use this application of the BSC modified framework as guidance for their improvements.

The final rank resulted from the sum of each four ranks of perspectives' ranks, and indicates the relative performance of each DMU. Therefore, the final rank illustrates each DMU with relative and balanced significance. This methodology could be considered as a useful tool for constructing DEA to each case public organisation.

7. Conclusions

BSC is a powerful MA tool that has evolved in response to the ineffectiveness of traditional cost accounting practices *(Kaplan & Norton* 2001, 2001a).

BSC not only helps a public training centre to accurately measure its structure, trainee service, customer/citizen and learning & growth perspectives, but also provides the financial and non-financial information necessary to identify opportunities for the cost reductions and operating improvements of each unit. There is limited coverage for direct cost plus the absence of indirect cost of trainees, due to limitations of data availability. Therefore, these limitations appear more in outputs results rather in inputs *{Henderson, 1990).* Quality indicators covered these overcomings, meaning that in public decision making units performance rankings rather than costs of each unit is more important due to the absent of profit *(Vasilakis, Paggios and Papadeas 2004).* Despite these problems (showing the theoretical connections between the research contribution and the problem solution) by refining theory about the relationship of trainee focus and performance measurement, it provides one seed for an internal organizational test of BSC. The adopted trainee perspective instead of customer of the Scorecard was constructed to be a measurement system for performance for the differentiation strategy of the training center that takes the logic of trainee orientation into consideration. As trainee perspective scorecard, such as the one described but not implemented, it is possible to claim the integration of trainee focus into strategic performance measurement.

Its seems clear that BSC is not a panacea for keeping a balance in attending the organisation's performance, but it has a lot to offer in improving the relationship of indicators' allocation to each perspective for actual usage of service and, consequently, also improving the efficiency of allocations *(Kaplan & Norton 1996, 1996a, 1996b).* The applied framework for measuring relative performance in line with trainee focus would have been against some of the traditional measurement principles suggested by the financial manager and the Managing Director of the training center. In their view, it was important to keep measures approximately the same across performance (quality) indicators in order to allow aggregation of measures and benchmarking between different responsibility area units. Moreover, this approach would support keeping costs of efficiency measurement in minimum (See also *Henderson, 1990)* despite any limitations.

In order for each DMU to keep costs down, it was also addressed that existing information should be preferred in order for the public training organizations to set priorities through the KPIs of the applied BSC. As *Avkiran* (2002) stated *'BSC plus DEA is an almost obvious marriage'.* Indeed, in its early years, linear programming (of which DEA is a variant) was sometimes referred to as activity analysis *(Dorfman, Samuelson & Solow,* 1958). The detail information

on inputs, outputs, results and outcomes that BSC generates often at a high cost is directly applicable to the DEA algorithm that tries to establish whether individual units are getting the most output out of their given inputs for each individual perspective.

In the first stage of the analysis the merger of BSC and DEA provides a two-dimensional portrayal of a public training centre organisation across four adjusted perspectives and selective individual indicators. Therefore it illustrates the relative importance of a particular DMU by keeping the balance between the four different BSC perspectives.

In the second stage of the analysis, the relative efficiency score ranks every DMU. This is established from the peer BSC, getting an estimate of how much benefit is possible of each particular directory overall and in each particular perspective.

Finally, in the third stage of the analysis, *'the establishment of the efficient frontier consisting of the best performing DMUs, could be used as a guide to what to do for the DMU managers' {Paradi, 2002: p.32).* Consequently, inefficient directories could use the guidance of the frontier for their improvements. The rankings of DMUs, seems to have greater significance rather the cost for the relative performance.

8. Future Research

There are huge differences concerning the work-task at each responsibility area-level. Along with the research on how training affect the implementation process the researcher has identified some factors (see applied KPIs) that seem to be of importance in order to understand why training activities alone do not lead to implementation success. Some important factors that need to be considered in future research are the time-factor, model characteristics, individual characteristics, group characteristics and task-specific characteristics. Although the personnel might want to create and use scorecards, the work can be too time-consuming and costly, thus functioning as a barrier to implementation success. Earlier research process covers the implementation of different kinds of new knowledge *{Chang & Chow, 1999; Tuomela, 2003)* was unsuccessful. In this case, it concerned the quality indicators of BSC *{Chang & Chow 1999, Vasilakis, Paggios and Papadeas 2004).* However, it would be interesting to compare how model-specific characteristics affect the implementation of new knowledge. In a sense it also seems important to consider how task-specific characteristics may effect how the BSC is received and accepted.

While trying to understand how training can affect -and to what extent- the work of civil servants or groups there is also a need to consider individual and group characteristics. Two different field research should follow, firstly to trainees and secondly to supervisors of the trainee. The matching of two different field research data could produce powerful results for the relative performance of each DMU separately. Future research can elaborate on one or more of these characteristics to find out how they can work as influences or barriers to implementation success.

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