The Connection of Activity Based Costing to the GRAI Integrated Methodology for Reengineering Purposes

I.P. Tatsiopoulos, A. Xerokostas and N. Panayiotou
NTU Athens, Mechanical Engineering Dept., 15780 Zografos, Greece
E-Mail: itat@central.ntua.gr, Fax: +301 3811855

Abstract

This paper describes an approach to integrate the Activity Based Costing (ABC) technique within the framework of GRAI Integrated Methodology (GIM) in order to assist business process reengineering justification and evaluation. The first step of integration is to have ABC adopt cost pools and lists of activities derived from GIM process modelling. Further on ABC is involved in two stages of the methodology: (a) ABC adds to the ECOGRAI method of performance modelling by supporting the determination of the right performance indicators that are responsible for business process costs. (b) ABC is a sound approach to translate operational performance indicators not found in accounting ledgers into financial terms and the company's profit bottom line.

Keywords

Reengineering, Benchmarking, Activity Based Costing

1. INTRODUCTION

This is an account of work done within the ESPRIT project REALMS. This project's goal was to prove that the integration of enterprise modelling, activity based costing (ABC) and simulation to support reengineering is feasible based on the selected methods and that such a tool would lead to considerable benefits for the pilot users.

The long term goal of the project is the development of an integrated methodology and software tool to support business process reengineering and benchmarking in mid-sized european companies. No similar integrated tool existed up to now that combines different scientific disciplines (*systems analysis, simulation, cost accounting, engineering economics, management consulting*).

2. APPROACH

The methodological steps followed in the REALMS project that combine the GRAI Integrated Methodology (GIM), (Doumeingts 1984), and Activity Based Costing

G. Doumeingts et al. (eds.), *Modelling Techniques for Business Process Re-engineering and Benchmarking*

(ABC), (Berliner 1989, Innes & Mitchell 1990) for reengineering purposes are the following (Figure 1). The main difficulty in this kind of project is to detect the activities that need reengineering.

1. *Model a Pilot Users' Critical Business Process.* The modelling tools used are those of GIM, i.e. IFEF-0 for the physical and functional views of the business process, GRAI-grids and GRAI-nets for the decisional views. Those tools are included in the software product IMAGIM.
2. *Develop a Performance Model for the selected Business Process.* The performance measurement tool used is the ECOGRAI methodology (Doumeingts, Clave and Ducq, 1995) to define performance drivers (time, quality, cost/productivity) in relation to the objectives and the decision variables of the business process. Activity Based Costing (ABC) is added here to the ECOGRAI approach in order to support the determination of the right performance indicators that are responsible for the business process costs (cost drivers).
3. *Conduct Benchmarking* based on the performance model developed in step 2. Identify examples of best practices, compare to the existing performance indicators and set targets to be pursued by the reengineering actions..
4. *Evaluate reengineering targets.* Those targets set in step 3 are usually expressed in the form of operational indicators (e.g. lead times, inventory levels, etc.). Those indicators need to be translated in financial terms, a task which is almost impossible to be handled by traditional cost accounting systems. Activity based Costing (ABC) seems to be here the ideal approach to calculate *Return On Investment (ROI)* coming from the improvement of such operational indicators.

A more detailed description of those parts of the above approach that require the integration of Activity Based Costing is presented in the next paragraphs.

2.1. Model a Pilot Users' Critical Business Process

Among the possible set of processes that represent material/information flows across the logistics chain, the *Customer Order Flow* (Rolstadas, 1993) has been chosen in this project as been the most critical from the pilot users' point of view, in order to be the subject of business modelling and reengineering.

The Customer Order Flow involves and cuts across the Sales, Costing, Product Development, Production Planning and Shipping/Distribution functions of both Pilot Industrial Users. The two Pilots are absolutely complementary across the value chain in the specific user sector of semi-processing of non-ferrous metals. ELVAL (GR) is a producer and supplier of semi-processed aluminium products, while TUBUSMETALL (D) is a wholesaler of non-ferrous products and a producer of components using semi-processed raw materials (Figure 2). For both of them the Customer Order Flow is of utter importance due to the vast number of product varieties according to customer requirements.

The processing of customer orders considers the logistics chain from the customer´s request to the delivery of the product. The first step is to calculate the costs and the delivery date for a customer request concerning the capacity resources, the costs of raw material, etc. Furtheron, the price which will be proposed to the customer has to be calculated based on the

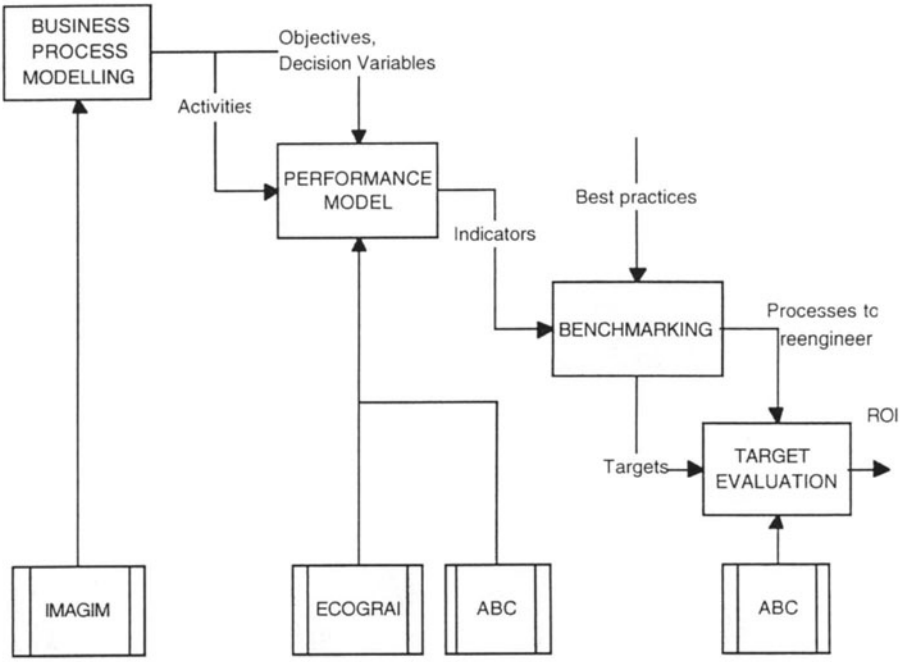


Figure 1 Overview of the approach.

estimated costs. The price and the date are fixed in the bid to the customer. On this basis the customer will negotiate with the company. If the negotiation was successful, the negotiated delivery date and price will be fixed in the customer order. After the realization of the customer order the company can post-calculate the costs and the final delivery date is known.

2.2. Develop a Performance Model for the selected Business Process

The performance model includes a system of key indicators:

1. Operational indicators concerning time-based and process quality (reliability) performance measurement. For the business process and its critical activities chosen in this project (customer order flow and delivery date/price assignment decisions) this translates into indicators having to do with *delivery lead times (time-based)* and their *deviations (process quality).* Another class of quality indicators is the *reliability of cost and price estimations* used to respond to customer requests.
2. Cost drivers and their reciprocal cost rates developed using the Activity Based Costing technique (ABC). The activities of ABC coincide to the activities of the activity model developed with GIM, thus making easier communication and integration of the key indicators model. For the Customer Order Flow process, the ABC technique leads to a more fair distribution of *overhead costs* to customer orders that either require *special products/customers* or *small batch quantities*, compared to whatever is considered a standard product or a normal batch quantity ordered. This permits a better assignment of product prices.
3. Productivity-driven indices of the Customer Order Flow process help to evaluate changes in sales output caused by accepted customer orders and changes in productivity caused by the treatment of those customer orders (e.g. manufacturing or

outsourcing) using a profitability-based modelling approach. Those indices are based on *variable cost* calculations, that help to define product profit contributions and profitable customer orders ,and therefore they are complementary to the ABC cost drivers that deal with the distribution of fixed costs in pricing decisions (Eilon & Cosmetatos 1977, Cosmetatos & Eilon 1981, 1983, Cosmetatos in REALMS-WP3 (1996).

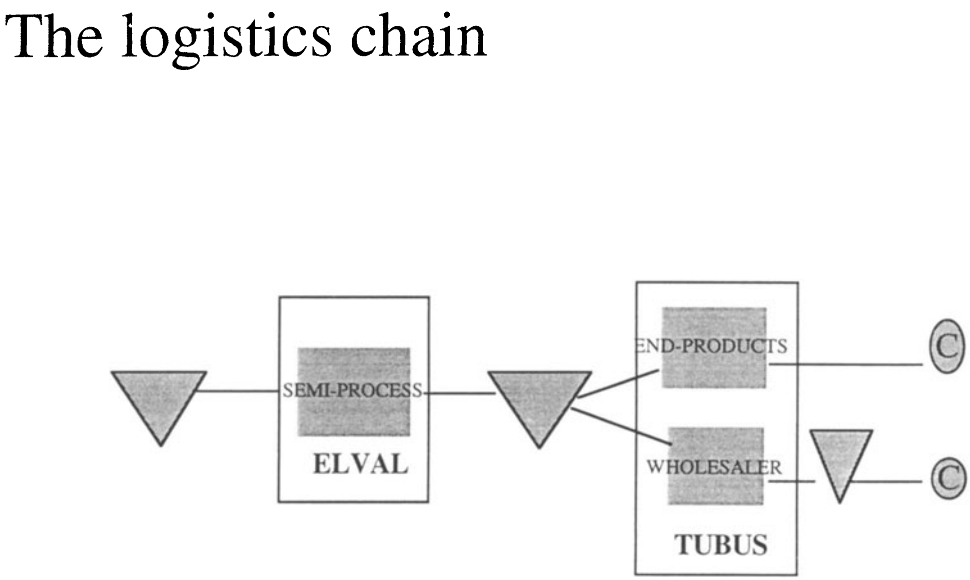


Figure 2 The logistics chain of the two pilot users

As seen in Figure 1, the performance model needs the input of activities that have been specified in IDEF-0 diagrams with the help of IMAGIM (Figure 3). Constraint information for the performance model are the objectives (OBJ) and the decision variables (DV) of the decisional activities shown in the GRAI-nets (Figure 4). The performance model itself is supported by ECOGRAI and ABC methods to produce a set of performance indicators (PI) that feed the benchmarking activity. The role of ABC is to support the determination of PIs that are drivers of business process costs. The collection of ABC data for the customer order flow process in the two industrial users has been done with the help of the form of Figure 6, where the IDEF-0 and GRAI-nets activities coincide to the ABC activities.

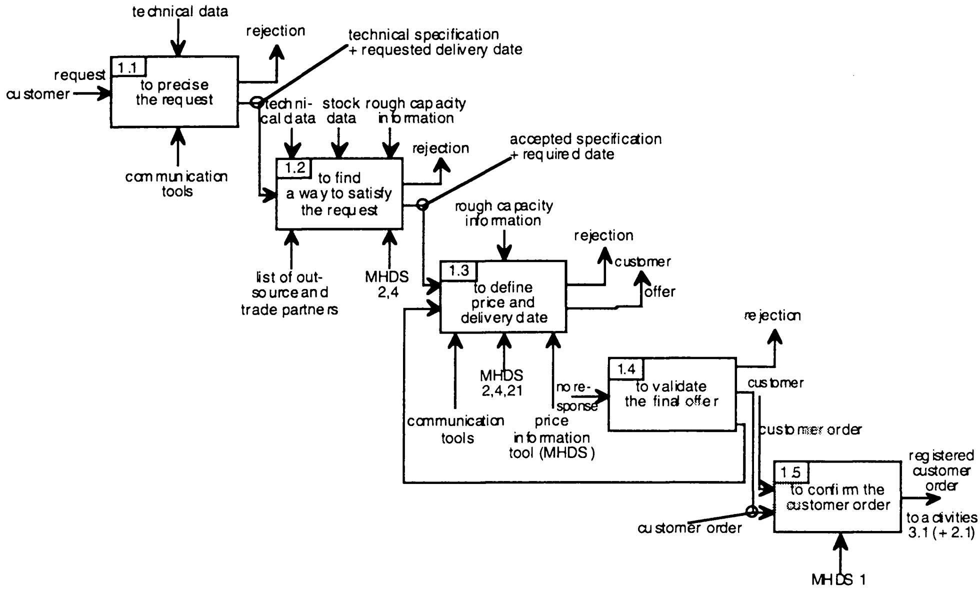


Figure 3 A1-Level - to create a customer order (activity 1). © REALMS Consortium (1996)

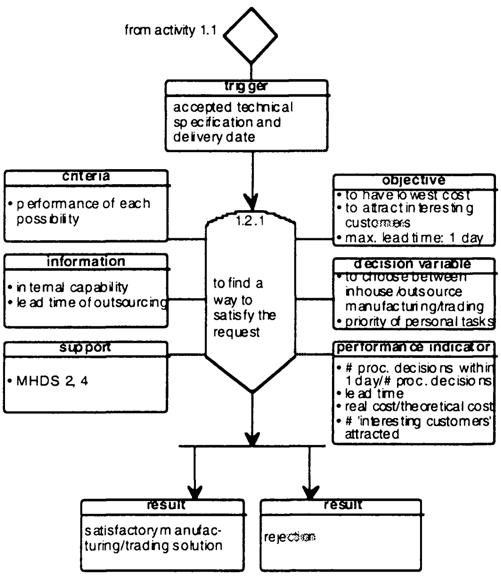


Figure 4 GRAI net - to find a way to satisfy the request (activity 1.2), © REALMS Consortium (1996)

Activity Based Costing (ABC)

This method has been proposed as a solution to the overhead cost allocation problems. ABC differs from conventional costing in its treatment of non-volume related overhead costs. Many significant *overheads are related to specific activities* which are relatively independent of production volume. It is the volumes of such activities (not the volume of production) which consume resources and therefore determine the overhead cost. These activities drive the overhead costs and ABC uses such activities for both product costing and process control.

When activities are segregated in this way, a hierarchy emerges. Some activities, like hot-rolling, are performed on individual units. Others - setups, material movements, and first part inspections - allow batches of units to be processed. Still others -engineering product specifications, process engineering, product enhancements, and engineering change notices - provide the overall capability that enables the company to produce the product. And plant management, building and grounds maintenance, and heating and lighting sustain the manufacturing facility.

Business process information is enhanced by using a measure of the volume of each activity (or cost driver) to generate a cost rate which could be used not only to cost production but also a performance measure for the activity concerned.

Internal cost drivers and induced cost drivers in a manufacturing environment

The customer order promising process (delivery date and price assignment) includes a mix of executional and decisional activities. Those activities consume *internal process resources*, mainly of administrative nature (salaries and other equipment and operational overhead expenses of the sales dept., costing dept. and engineering dept.).

The allocation of this kind of expenses is done with the help of ***Internal Cost Drivers*** whose consumption volumes characterize the internal work of the business departements that directly take part in the order promising process.

However, the characteristic of the decisional activities of the order promising process in manufacturing is that they *seriously influence the factory overhead expenses* (see Figure of the ABC Hierarchy) and the cost drivers of factory *support activities*. For example order promising decisions to accept special products influence the "PRODUCT SUSTAINING ACTIVITIES", and decisions to accept small orders influence the "BATCH LEVEL ACTIVITIES". Consequently, we define the so-called ***Induced Cost Drivers*** of factory support activities (Figure 6).

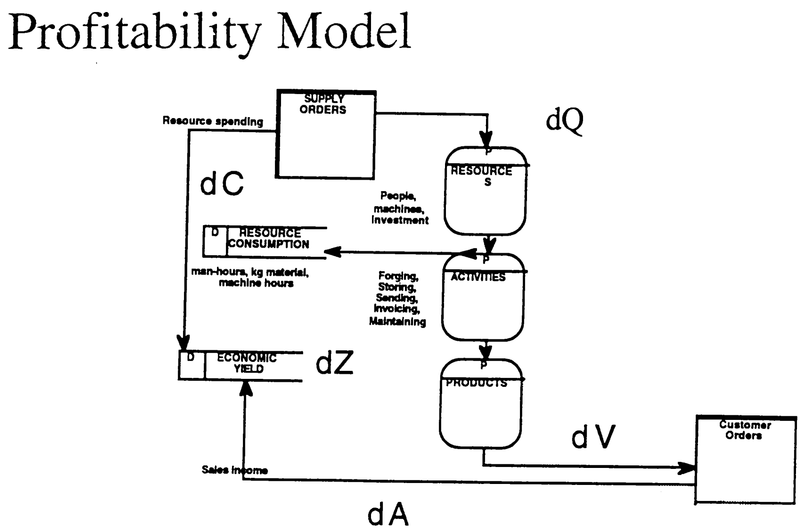
2.3. Target evaluation

This part of the approach follows benchmarking, where examples of best practices have been detected and compared to the existing performance indicators of the industrial users. The outcome of benchmarking is a set of processes to reengineer with their associated targets expressed in performance values.

The component productivity measures that evaluate the performance of a single activity or a relatively small organizational unit (*indicators*) assist firstline managers in improving productivity. Goals are established for the productive use of resources, and actual performance is compared to the predetermined objectives. New thoughts on this subject in relation to advanced manufacturing environments (Kaplan, 1990) claim that traditional summary measures of local performance - purchase price variances, direct labor and machine efficiencies, ratios of indirect to direct labor, volume variances - are harmful and probably should be eliminated, since they conflict with attempts to improve quality, reduce inventories, and increase flexibility. Moreover, direct measurement is needed for quality, process times, delivery performance, and any other operating performance criterion that companies want to improve (Zuelch, Grobel, Jonsson 1995).

However, these operational measurements have somehow to show ability to integrate with financial measurements in order to support the improvement of the company's bottom line. What is needed is a *translator* of operational (or logistics) performance indicators into financial terms having to do with the profits bottom line of the company. The role of this translator is played in our approach by ABC.

Profitability modelling based on overhead costs (ABC)
The following Figure shows the basic profitability model used. The main difference from traditional engineering economics models is that products do not consume resources (production factors) directly (at the unit level). Instead, they consume resources through activities. In our example the Customer Order promising process (*"A1. to create a Customer Order (C.O)"*, *"A12. to find ways to satisfy the request"*, *"A13. to define delivery date & price"* according to the GIM activity model) should guide the company *to accept customer orders that increase profitability.*



dV=Change of customer orders mix, dA=Change of sales economic value, dQ = Change of resources, dC=Change of costs, dZ= Change of profits

Figure 5 Profitability model.

The use of Activity Based Costing avoids the pitfalls of traditional costing practices, where standard products (in terms of product specifications, lot sizes and delivery conditions) subsidize special products (Cooper & Kaplan, 1991). A more fair distribution of overhead costs using activity based cost driver volumes results in better pricing decisions: «Raise prices for customer orders that make heavy demands on overhead resources and lower prices to more competitive levels for high-volume standard products. With this repricing strategy the company should arive at a new customer order mix that either makes fewer demands on its resources or generates more revenues for the same consumption of resources»

3. RESULTS

Results of Activity Based Costing for Customer Order Flow activities that have been specified by GIM are shown in Figures 7,8, and 9. For two example product groups (sheets and coils) of an industrial pilot user the internal and induced cost drivers have been determined (Figure 6) Their volume as well as the relative consumption and costs of the activities have been calculated. These costs may be used to evaluate the following reengineering actions:

- Calculate the financial impact changing performance indicators' values
- Reduce the number of activities of the business process (effectiveness)
- Reduce resource consumption per activity of the business process (efficiency)
- Make better decisions (e.g. price and due date assignment, inventory policy)

	Sheets	Coils		Activity
No of Customer Orders	18985	12169	Inner Cir.	A1,A1.5
No of Customer Requests	23438	15023		A1.1
No of Offers	21094	13521	Outside C.	The rest

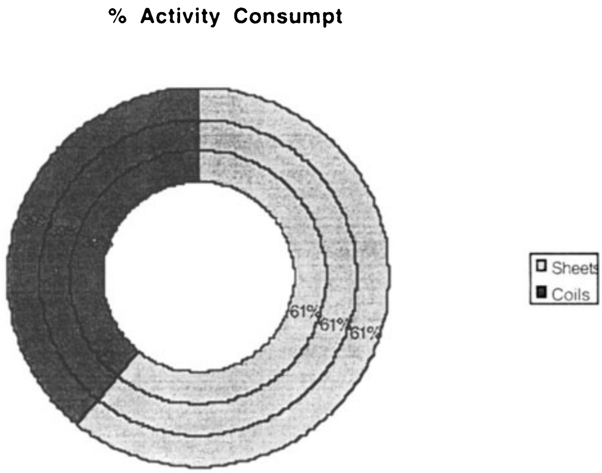


Figure 7 % Activity Consumption for two different products (Sheets & Coils)

PRODUCT GROUP:

ACTIVITIES	No. of persons	Equipmt /other cost (%)	Total Activity Annual Cost	(%) Relative Consumption of Activity (per product group)	INTERNAL COST DRIVERS	COST DRIVER VOLUME (per product group)
A1. TO CREATE A CUSTOMER ORDER						
A1.1. to precise the request					No. of Customer Requests	
A1.2. to find a way to satisfy the request					No. of Offers	
A1.3. to define price & delivery date					No. of Offers	
A1.3.1. to calculate price & delivery date					No. of Offers	
A1.3.2. ro negotiate with customer					No. of Offers	
A1.3.3. to send offer to customer					No. of Offers	
A1.4. to validate the final offer					No. of Offers	
A1.5. to confirm the customer order					No. of Customer Orders	
SUPPORT ACTIVITIES					**INDUCED COST DRIVERS**	
Setup					No. of setups	
Material handling					No. of material movements in [tn*Km]	
Material procurement					No. of supplier orders	
Quality control					No. of inspections	
Machine processing					Std. labour hours Std. machine hours	
Packing					No. of shipments	
Prod. Planning & Control					No. of production orders	
Shipment					No. of shipments No. of customer orders No. of customer order lines No. of invoices	
Engineering design					No. of special product design orders	

Figure 6 The data collection form for Activity Based Costing.

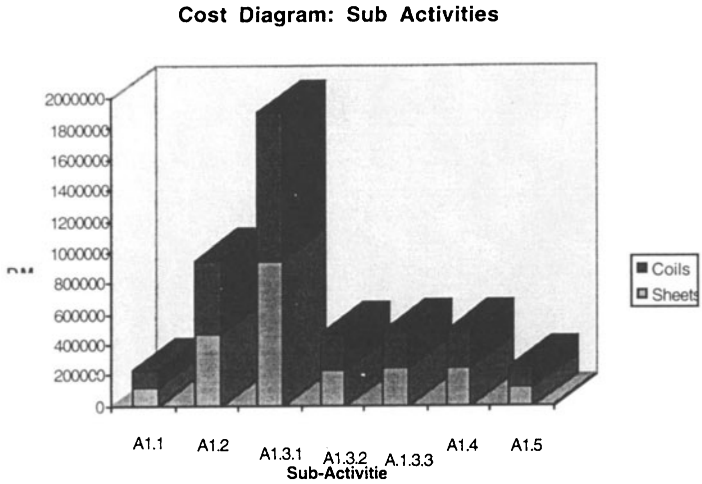


Figure 8 Costs for Sheets and Coils for sub-activities of A1 (To create a customer order)

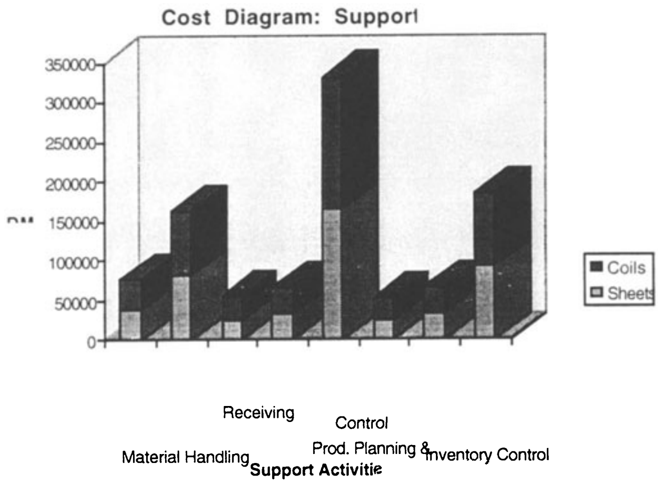


Figure 9 Costs for Sheets and Coils for support activities

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5. BIOGRAPHY

ILIAS P. TATSIOPOULOS is an Asst. Professor in production management at the Industrial Management and OR Section of the National Technical University of Athens (NTUA). He has been active for several years as a professional production engineer in both industrial and consulting firms and he served as a Lecturer in management information systems at the Economic University of Athens. He studied Mechanical and Industrial Engineering at NTUA (1978) and followed post-graduate studies at the TH Aachen (Germany) and the University of Lancaster (UK) under a NATO grant. H holds a PhD (1983) in Operational Research from the University of Lancaster. He is a member of the Senate of NTUA and Vice-Chairman of the Greek Institute for Production Management (HMA).