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Time-Driven Activity-Based Costing in the Public Sector. The Case of Greek General Chemical State Laboratory under the Greek Crisis

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Abstract: The international globalized environment and the financial crisis have generated new demands with internals (citizens-users) and externals (creditors) pressuring the governments to control public spending and improve efficiency in the supply of public goods/services. The control of the public sector costs seems more important now, in the context of the financial and fiscal crisis of 2008. Activity Based Costing (ABC) and Time-Driven Activity-Based Costing (TD-ABC) are recent innovations in cost accounting methods used for determining 'true' costs. In the light of current practices, this paper aims to showcase the need and importance of activity based costing in the public sector, in order to promote more effective financial management, a higher degree of transparency and accountability of public spending and to disseminate a 'cost culture' in the public administration. In the case of the Greek General Chemical State Laboratory (GCSL), the TD-ABC method and monitoring system have been applied in order to determine the resources (inputs) and activities drivers, to allocate the activity cost to the cost objects and to monitor the public services/goods (outputs).

Keywords: Activity Based Costing (ABC), Public Administration, Accountability, Greek Crisis

Introduction

At the beginning of this article we review the literature in order to provide the definitions of the costing methods and why they were developed. Next the basic principles and implementation steps are presented for the Activity Based Costing (ABC) and the Time-Driven Activity-Based Costing methods (TD-ABC).

Cost determination in the public sector is more essential now due to the financial crisis of 2008. The main purpose of this article is to examine whether the implementation of Activity-Based Costing methods is possible in the Public Sector and how the cost analysis can lead to public accountability. In this study, we implement the ABC method at the Greek General Chemical State Laboratory (GCSL) of the Greek Independent Authority of Public Revenue (IAPR). To achieve this, the study needs to identify the public expenses ('inputs'), the public goods services/products ('outputs') and the activities of GCSL. The financial cost data is collected (personnel cost, goods and equipment cost, operational supplies, facilities cost, miscellaneous cost etc.) and cost calculations are made. Also, the public goods/services provided by the GCSL are gathered and presented. Additionally, the major activities of GCSL are presented.

Also, in order to determine the resources and activities drivers and to allocate the activity cost to the cost objects, a TD-ABC questionnaire was developed for the two (2) main sectors of GCSL: (a) Chemical laboratory analysis and (b) audits on excise duties and inspections on facilities/products.

Moreover, taking into account the 2008 fiscal crisis of 2008 in Greece, data was collected on the basic countermeasures taken to reduce the public spending and the structural reforms implemented in the Public Sector.

Literature Review

In recent years, companies have reduced their dependency on traditional accounting systems by developing activity-based costing management systems (Kumar and Mahto, 2013). Traditional costing systems

added a broad percentage of expenses into indirect costs. However, as the percentages of indirect or overhead cost rose, this methodology became increasingly inaccurate. Activity-Based Costing (ABC) was a new tool that was developed in the manufacturing sector in the 1970s and 1980s in an effort to improve efficiency and control cost.

ABC was pioneered by Copper, Kaplan and Johnson and is a costing methodology used to mark out overhead costs directly to cost objects (product, services, processes or customers) and help managers make the right decisions regarding product mix and competitive strategies (Ray, 2012).

Cooper (1988; Cooper and Kaplan, 1991) reported that the ABC system was developed and has been advocated as a means of overcoming the systematic distortions of traditional cost accounting and thus bring relevance back to managerial accounting.

Kaplan (1994) reported that in the early 1980s ABC was already used in the service sector by logistics companies, banks and hospitals and costing models similar to the ABC had already been developed.

Kaplan and Anderson (2013) mentioned that since the traditional ABC model had several limitations, the time driven activity based costing model was proposed due to its simplicity and accuracy. Time driven ABC is easy and fast to implement.

Vazakidis and Karagiannis (2006) presented for the first time a model of cost accounting for the Department of Applied Informatics of the University of Macedonia in Thessalonica, initially for internal purposes and at a later stage for the promotion of this new method in the Greek environment.

Kaplan and Anderson (2004; 2007) described a Time-Driven Activity-Based Costing (TD-ABC) approach to overhead allocation in order to help provide accurate product unit costs.

Vazakidis *et al*. (2010) investigated the relevance of ABC in the Greek public sector. Their findings revealed that when combined with new technologies and new methods of management, ABC can resolve public sector deficiencies and help produce services at minimal cost.

Dejnega (2011) presented a literature review of the TD-ABC method, as an instrument for better assignment of costs to activities comparing it with Activity Based Costing.

Kusek and Rist (2004) concluded that 'while the role of the state has changed and evolved during recent years, it is now readily apparent that good governance is key to achieving sustainable socioeconomic development. States are being challenged as never before by the demands of the global economy, new information and technology and calls for greater participation and democracy.'

Based on CIMA (2005) report, cost management can be defined as the application of management accounting concepts, methods of data collection, analysis and presentation in order to provide the information needed to plan, monitor and control costs.

Horngren *et al*. (2009) described that cost management systems are used to calculate the cost of products, services and other cost objects, to obtain information for planning and control and performance evaluation and to analyze the relevant information for decision-making.

Buttross and Schmelzle (2003) re-emphasized ABC adoption in the public sector and suggested that it can provide useful information on the cost of providing government services for strategic decisions.

According to Hood (1995), New Public Management (NPM) include a focus on the reduction of budgets, decentralization of activities to corporatized units, an emphasis on performance management and the prominence of managerial accountability.

Methodology of ABC Systems

Definitions

According to Oseifuah (2014) and Vazakidis and Karagiannis (2006) relevant definitions are presented below:

- **Traditional Costing Accounting (TCA)** methods have a tendency to assign indirect costs based on something easy to identify (such as direct labor hours). This can make indirect costs allocation inaccurate. (no actual relationship between cost pool and cost driver)
- **Activity Based Costing (ABC)** is a method for determining 'true costs'. It assigns costs to activities thus enabling more accurate cost information.
- **Time-Driven Activity Based Costing (TD-ABC)** requires fewer accounting transactions than the common ABC allocation method and still turns out an accurate computation of product unit costs

Implementation of ABC

Based on Vazakidis and Karagiannis (2006) and Lima (2012) reports, the steps in the implementation of ABC are:

1. Identify expenses (cost resources)
2. Identify end-products/services (outputs-cost objects)
3. Identify activities (cost pools)
4. Assign resources to activities (based on resource driver)
5. Trace/allocate overhead costs to activities and cost objects
6. Assign activities to products/services (based on activity driver)

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Advantages and Disadvantages of Activity-Based Costing

As mentioned before, Activity Based Costing methods (ABC and TD-ABC) determine 'true' costs by assigning more indirect costs (overhead) into direct costs through activities.

According to Khodamipour and Yazdinejad (2014), the TD-ABC shows a number of advantages illustrated in different case studies:

- Simplicity (parameters needed: cost per time for an activity and time needed to perform an activity)
- Complex Operations (by using multiple time drivers)
- Capacity Utilization (for a clear estimation of resource consumption)
- Versatility and Modularity (updated more easily)

On the other hand, opposed to the benefits of TD-ABC there is some criticism, concerning:

- Measurement error (fear and unwillingness of employees to state the precise working time, ignore idle or unused time)
- Data collection (by observation, interviews and via questionnaires) could be costly
- Similar and repetitive activities
- Complexity (degree of subjectivity involved)
- Cost driver rate is inaccurate (full capacity instead of a practical capacity)
- Limited integration between ABC systems and other management information systems

ABC and TD-ABC Applications in the Public Sector

The international globalized environment and information and paradigm dissemination have generated a new awareness and new demands by the citizens-users pressuring the public managers. Managers are asked to improve performance and efficiency in the supply of public goods and in the management of public institutions, relying on the principle of the lowest cost in conjunction with maintaining the highest quality. Recent demands request for increased transparency and improved quality of public sectors all over the world, calls for managerial techniques to control public sector's spending. In such situations, whereas the cost determination is the central problem it is nevertheless indefinable to the management of firms supplying public goods and services.

Vazakidis *et al*. (2010) described that in the modern financial situation, the Public Sector aims to a continuous improvement of quality of the provided services.

The Greek General Secretariat of Public Revenue (*G.S.P.R.*)*/Independent Authority of Public Revenue* (*I.A.P.R.*)

On 1/1/2017 the Greek General Secretariat of Public Revenue became an Independent Authority. The new Authority is not supervised by the Greek Ministry of Finance, but directly by the Greek Parliament (Fig. 1).

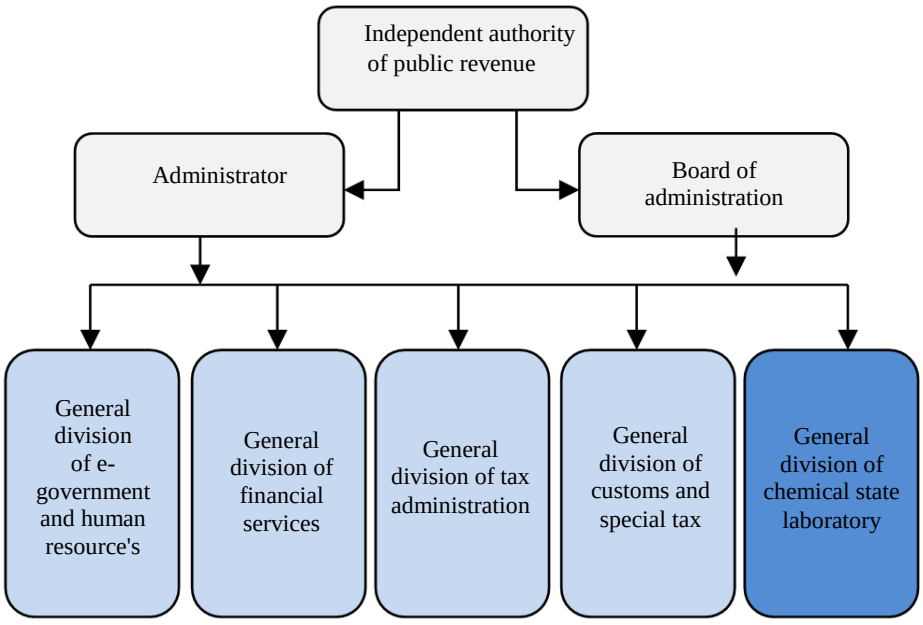

Fig. 1: Structure of I.A.P.R.

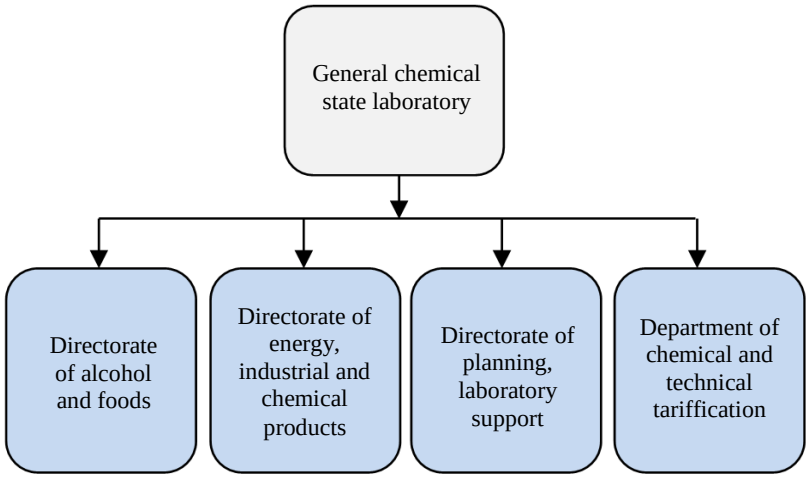

Fig. 2: Structure of GCSL

Structural Changes to the Greek Public Sector

In 2013, major structural changes were implemented in many Greek Authorities. More specifically, at the Greek General Secretariat of Public Revenue of the Ministry of Finance the number of organic units (divisions, departments, units) was reduced by 61%. More specifically, the total number of organizational units within the Tax, Customs and Chemical Authorities was reduced from 3282 to 1285 units. Due to the economic crisis in Greece, a major reduction of expenses on personnel cost, material supplies and equipment maintenance took place. Also the number of personnel was reduced due to pension retirements.

This study will present below the operational cost analysis for the Greek General Chemical State Laboratory and how the crisis and the changes that followed, have influenced it.

General Chemical State Laboratory of Greece (G.C.S.L.)

The General Chemical State Laboratory (GCSL) was established in 1929 (foundation law L. 4328) and until the end of 2016 belonged to the Greek Ministry of Finance. From 1/1/2017 it reports to the Greek Independent Authority of Public Revenue (Fig. 2).

The structure of G.C.S.L. after the major reorganization of 2013 is the following:

- 4 Central Divisions
- 14 local Chemical Divisions (including 25 Departments and 10 local offices)

ABC Implementation in G.C.S.L.

The first steps of the study were to collect the financial data for the ‘cost resources’ (personnel expenses, operational and supplies expenses) and the data for the ‘cost objects’ (analysis and audits from the annual reports). Also, the ‘activities drivers’ were identified.

Moreover, a main issue is the understanding of the working processes and gathering relevant information through personal interviews with directors and key employees, gaining familiarity with the main working strengths and difficulties.

The final step is to define the ‘cost drivers’ and to connect the cost to the activities. In order to trace the overhead costs, to calculate the activity rate and to assign the cost, a questionnaire was developed. The questionnaire was specifically designed based on the activities of GCSL.

The questionnaire consisted of three parts:

A. General data
B. Laboratory/chemical cost analysis
C. Inspection/audits cost analysis

Due to the large number of activities of the GCSL, the data from the questionnaire will be analyzed and presented at a subsequent paper.

Personnel Data (*Number and Cost*)

In the period of 2010-2017, the number of personnel was reduced by 30% mainly due to forced retirement (Fig. 3). In 2010, a large number of personnel were forced into retirement (-19%) Also, it should be noted that in 2013, a number of personnel for cleaning (basic school) were suspended and later returned to their posts, which explains the fluctuations in that number.

GCSLs’ personnel have extremely high academic qualifications (PhD, MSc, NPAS: National public administration school).

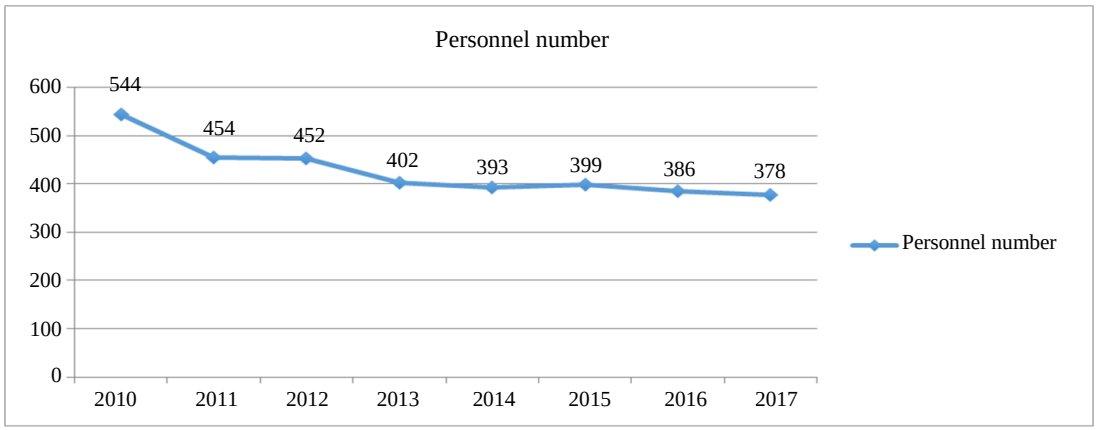

Fig. 3: Personnel number of GCSL for the period 2010-2017

Table 1: Annual average cost per employee based on level of education for the period 2009-2017 (inlc. wages, benefits and employer insurance and health cost)

Personnel average cost-annual	2009 (*14)	2010 (*13)	2011 (*13)	2012 (*13)	2013 (*12)	2014 (*12)	2015 (*12)	2016 (*12)	2017 (*12)
University education	37.120	29.361	29.361	29.361	27.102	27.102	26.831	26.831	26.831
Technological education	33.599	26.777	26.777	26.777	24.717	24.717	24.470	24.470	24.470
Secondary School	31.974	24.502	24.502	24.502	22.617	22.617	22.391	22.391	22.391
Basic School	29.699	22.552	22.552	22.552	20.817	20.817	20.609	20.609	20.609

The annual personnel cost of the GCSL was calculated as a distribution of personnel per level of education multiplied with the average personnel wage per level of education. The monthly personnel wage includes wages, allowances (family/children), benefits (position) and employer cost. Then the monthly personnel wage was multiplied the number of wages (14 or 13 or 12).

Due to austerity measures, two major reductions were made: (a) Reduction and finally abolishment of Christmas, Easter and vacation allowances (from 14 to 12 wages: -15% until 2013 due to L.3845/5-2010, L. 4093/10-2011) and (b) reduction of allowances and benefits (-12% and -8% at the beginning of 2010 due to the implementation of L.3833/3-2010, L.3845/5-2010).

Finally, the total annual personnel cost was calculated by multiplying the number of personnel with the annual personnel average cost per level of education (Table 1).

As shown Fig. 4, the personnel average wages were reduced by a total of -35% (-20% on allowances/benefits and -15% due to two fewer (14-12 = 2) wages) and the personnel number was reduced by -30% due to retirement. As a total, the annual personnel cost was reduced by -49%.

Expenses Data (*Exp. Personnel*)

The Annual Statement of Public Accounts of Greece and Diavgeia (The Transparency Program initiative, web the public site www.diavgeia.gov.gr) are the official sources for information regarding financial data of the Authority. These figures are personnel cost, goods and equipment cost, operational supplies (laboratory materials, maintenance and repair services, stationery supplies), travel cost, facilities cost (post, telecommunication, water-supply, electrical energy, heating, cleaning and other expenses), miscellaneous cost.

The main categories of public expenses per KAE (code number per expenses for the government expenses) are.

0000: PERSONNEL PAYMENTS & SERVICES

(civil servants wages (incl. health care and insurance cost), overtime/night employment, travel, post, communications, energy, water, cleaning, building maintenance, equipment fees etc.).

1000: SUPPLIES OF GOODS & EQUIPMENT

(office equipment/supplies, laboratories, health, cleaning products, maintenance and repair items, heating fuel, extras, etc.)

The expenses are in the public domain.

The GCSL's annual cost per expenses' category (exp. personnel) for the period 2010-2017 is presented Fig. 5. On the category Supplies of Goods and Equipment the total reduction was -61%, with a major reduction of -95% happening in 2014. On the category of Services (operational cost) the total reduction was -9%, with a major reduction of -50% happening in 2014. This was due to the fact that no public procurement procedures (for chemical materials, equipment maintenance items and supply, etc.) were held. The austerity measures led to a major reduction of public spending on all categories of expenses.

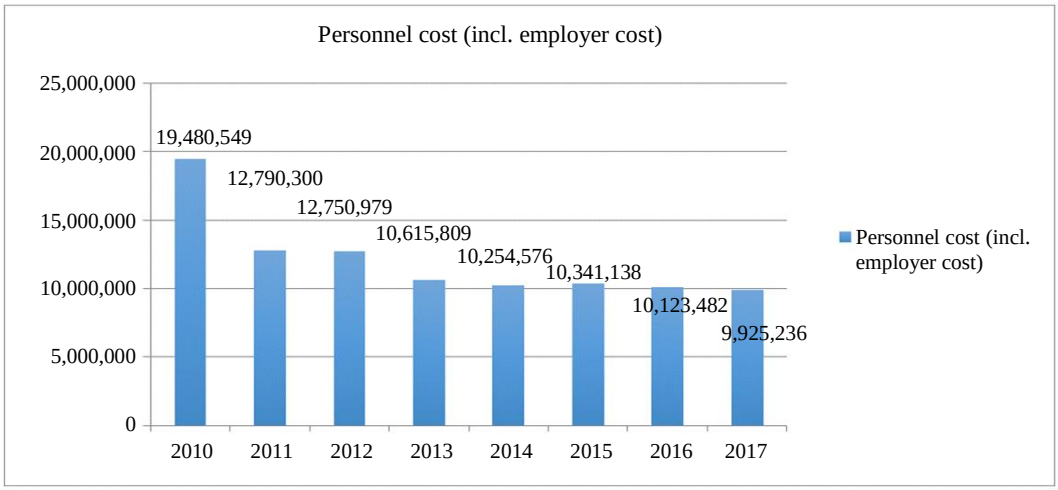

Fig. 4: Personnel cost of GCSL for the period 2010-2017

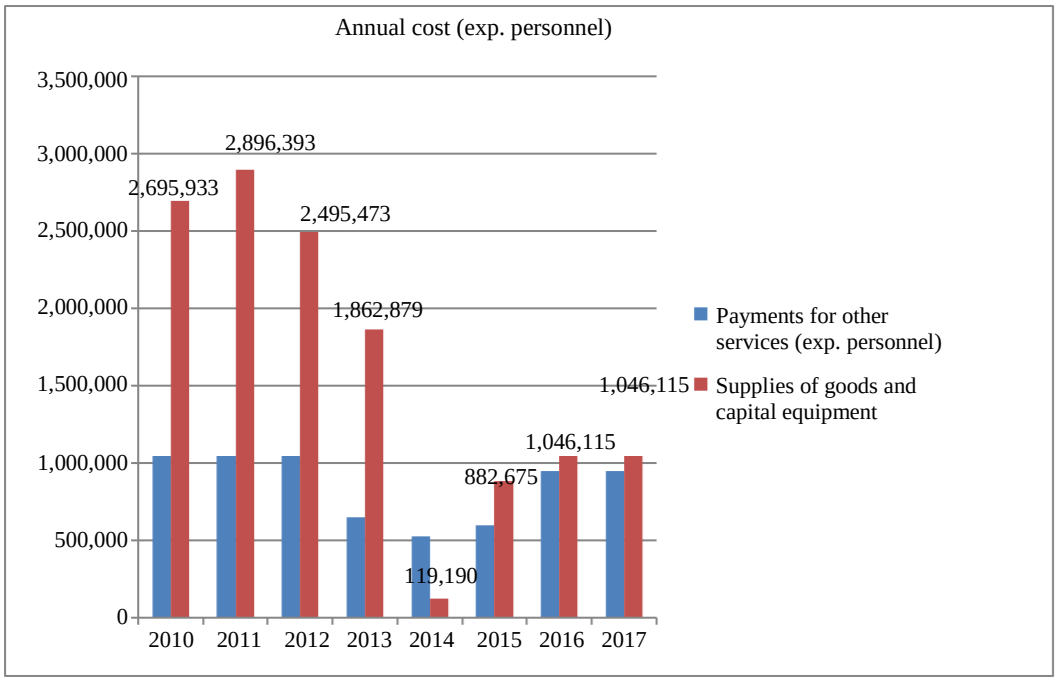

Fig. 5: Annual cost per category on Goods, Equipment and on Services of GCSL (exp. personnel) for the period 2010-2017

Activities-Annual Report

The main sectors at the GCSL are the following:

- Laboratory/chemical analysis
- Audits on excise duties/inspections on products/facilities
- Legal tasks
- Administration tasks

The Annual report of the GCSL provides the number of activities per category (a. laboratory analysis, b. audits on excise duties/inspections on/products/facilities and others) for the period of 2010-2017.

A. Sector: *Laboratory/Chemical Analysis*

The Fig. 6 to 8 present the number of chemical analysis per main samples categories for the period of 2010-2017:

- Chemical analysis (food, alcohol, water, petrochemicals, raw materials, environmental, tobacco)
- Chemical analysis/Statement of classification for customs
- Chemical analysis of controlled substances (drugs)

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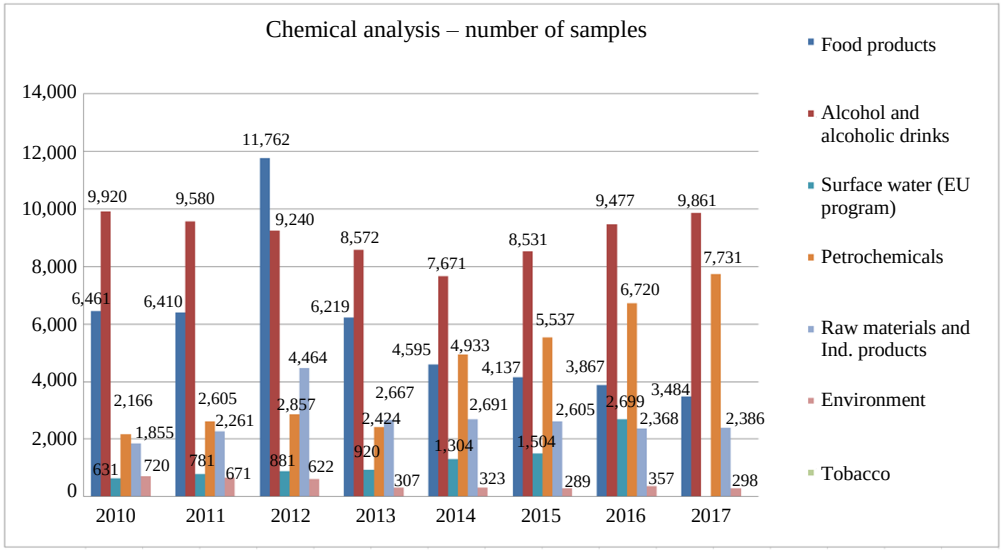

Fig. 6: Laboratory Chemical Analysis per major activity for the period 2010-2017

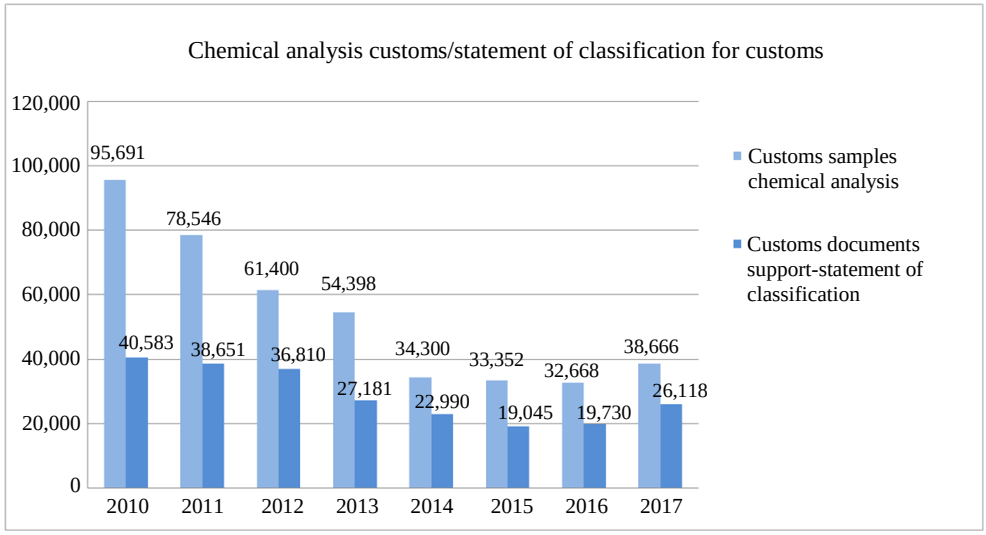

Fig. 7: Chemical Analysis/Statement of Classification for customs support for the period 2010-2017

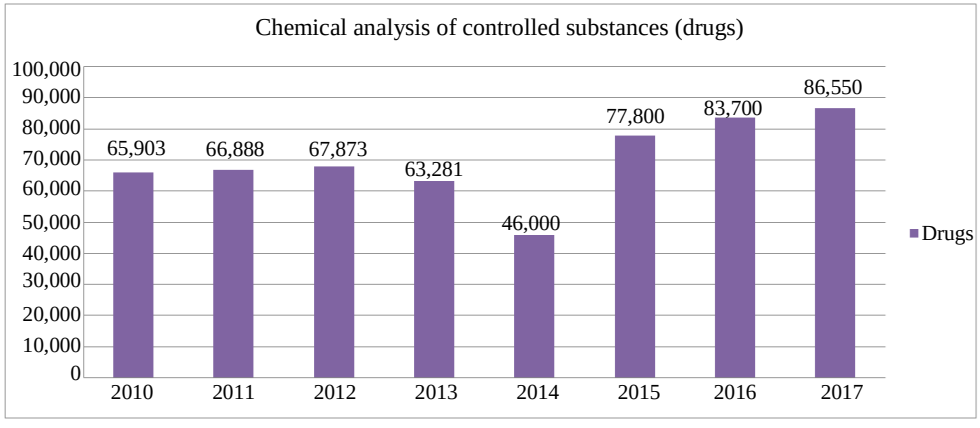

Fig. 8: Laboratory Chemical Analysis per major activity for the period 2010-2017

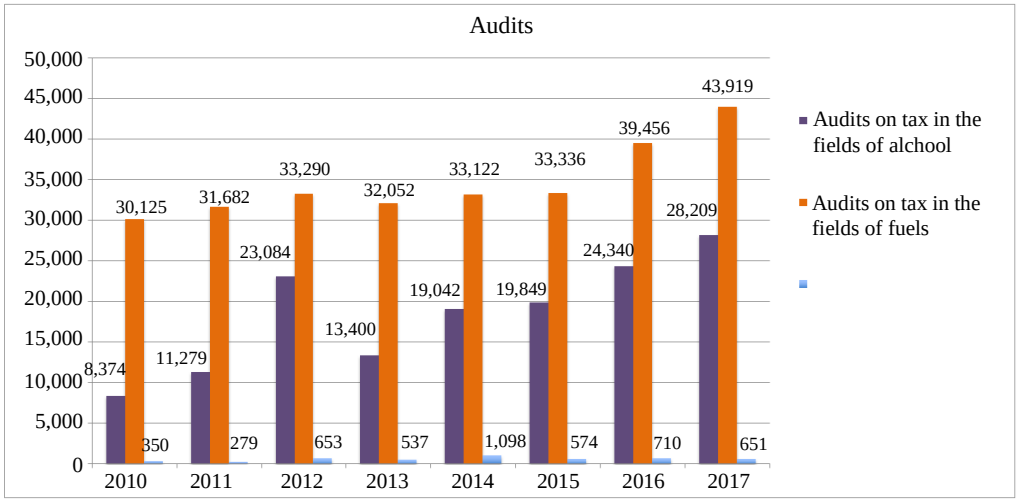

Fig. 9: Audits on alcohol, fuels and products and units for the period 2010-2017

As shown above, chemical analyses are performed in the fields of food, alcohol, water, petrochemicals, raw materials, environmental, tobacco and others, with a total decrease of -10%. (2010: 26.446 → 2017: 24.060 number of samples analyzed). More specifically, petrochemicals samples showed a major increase +256% (due to excite duties) and raw materials shows a major increase of +29%. Food and environmental samples were reduced by -46% and -58% due to fewer samples from other authorities.

Besides, the number of chemical analysis for customs samples was reduced by -60% and the number of statement of classification for customs was reduced by -35% due to the changes on the risk management method for samples selection by the customs. Furthermore, in the field of controlled substances (drugs) the number of samples is the highest in the category of laboratory chemical analysis tests and is increased by 31%.

B. Sector: Audits on Alcohol/Fuels Taxation/Inspections on Products/Facilities

The Fig. 9 presents the number of audits on alcohol and fuel taxation and inspections on products/facilities, for the period of 2010-2017:

- Audits for alcohol taxation (that include audits in distilleries, breweries, wineries, vinegar, bottling units and ethyl alcohol tax warehouses etc.) Increase of +236% (2010: 8.374 → 2017: 28.209)
- Audits for fuel taxation (that include tasks for determining quantity of petroleum in tanks, audits for issue of licences, on meters, on suitability etc.) Increase of +48% (2010: 30.125 → 2017: 43.919)
- Audits/Inspection on products and units (that include internal market, imports-exports, substances/facilities, volatile compounds, cleaning materials etc.) Increase of +86% (2010: 350→ 2017: 651 (+86%)

Results

The main purpose of this study is to make a cost analysis at a Greek Public Authority. For this case, the General Chemical State Laboratory (GCSL) was chosen and analyzed. The General Chemical State Laboratory (GCSL) is a public authority under the Greek Independent Authority of Public Revenue (IAPR). As a Public Authority it follows the state procedures for the approval and payment of the public expenses (‘inputs’) and also it monitors the produced public goods/services (‘outputs’). The particularity of this study is that it covers the time period of the Greek fiscal crisis.

Since 2008, Greece has faced a serious fiscal crisis and three Economic Adjustment Programs have been signed. (3 bailout programs: May 2010: 110b€, February 2012: 130b€, July 2015). This led to heavy austerity measures taken and many reforms on the operation of both public/private sectors. The austerity measures taken were on cutting wages/pensions, reducing the cost of public services (health, education and social) and increasing taxes.

In the case of GCSL, a major reduction of expenses (‘inputs’) on personnel cost, operational cost (services cost) and supplies cost occurred.

Due to the austerity forced measures the personnel average wages were reduced by a total of -35% (-20% on allowances and -15% due to two less wages). Additionally, the number of personnel was reduced by -30% due to forced pension retirements. In total, the annual personnel cost was reduced by -49% between years 2009 and 2017.

Furthermore, during the same period, at the expenses category ‘Supplies of Goods and Equipment’ the total

reduction was -61% and at 'Services' (operational/facilities cost) the total reduction was -9%.

On the other hand, concerning the public goods ('outputs') of the GCSL, the total number of chemical analysis of samples had a small decrease of -10%, with a major increase on petrochemicals (+256%) and an increase on raw materials (+29%) and a decrease on food (-46%) and environmental (-58%). The analysis for the customs was reduced due to new risk management assessment by customs authorities and to the general downturn in economic activity. Additionaly, due to the Greek crisis, measures for rising on taxation and duties, led to more audits on excites duties in the field of fuels (+236%) and alcohol (+48%).

The results clearly show an increase in the efficiency and productivity of the system, Indeed, a major structural reform occurred in 2013 across the Greek Public Sector leading to major unit merging (economy of scale). In the case of GSPR/IAPR, the number of units was reduced by -61% (3282 →1285). The consolidation of very small and small units into larger ones has led to a better use and optimal utilization of the personnel. This task required a very high level of knowledge, experience and expertise both by the officials and by their supervisors and was made possible because of highly qualified scientific personnel already trained in a wide range of processes and at the same time specialized (in lab and other technical work and in legal procedures) for specific activities.

GCSL has unique characteristics like: the wide range of activity fields and the large number of activities tasks (chemical methods analysis and inspection/audits tasks per activities category). Due to this diversity, complexity and labor-intensive tasks, the most suitable costing method is the activity costing method (ABC and TD-ABC).

Conclusion

Cost determination is a central problem, especially in public management, because it is always indefinable. Cost allocation basically means setting up budgeting and accounting systems in a way that allows administrators to determine the unit cost or the activity cost. Cost accounting methods can help to determine 'true' costs. Using the right costing method we could assign more indirect costs (overhead) into direct costs. The use of ABC method would be a useful tool for the administration decisions making for an efficient use of resources and improvement of the performance in the public sector.

Public management policies need to enhance accountability, transparency, effectiveness, productivity and utility of public goods and services. To achieve this, administration needs to collect the data, use this knowledge for better control and restructuring, get the feedback and evaluate, support professionalism and achieve cultural change.

The absence of public accountability and proper oversight in so many aspects of Greek public finances compounded the problems. (Kindreigh, 2017). The Greek financial crisis of 2008, led to mounting fiscal pressures and applied heavy horizontals reductions, based on expenditure control and not on performance budgeting. The current economic crisis requires insight in cost structures to evaluate cost reduction initiatives.

Cost management systems in public authorities are currently an issue in order to reduce costs, improve efficiency and improve the allocation of resources. The use of ABC costing system, can lead to better trace and allocate overhead cost and also to process improvement. (tools, roles, procedures, workflows, est.).

In Greek public authorities, it is more essential now, to adapt under the crisis situation, to gather the data, monitor the performances and rely on knowledge to rebuild trust insight the administration and between the administration and the citizens/consumers.

The recent worldwide request for better transparency and quality of the public sector, calls for managerial techniques to control the public sector's spending and for a continuous improvement of quality of the provided public services/goods. Governments nowadays are rethinking their models, trying to meet the needs of their citizens/consumers of public goods and services and disseminate a 'cost culture' in the public administration.

Busch *et al*. (2002) concluded that regardless of how one chooses to define efficient use of resources in the public sector and measure value creation, it will be up to the politicians to decide whether the services the public sector supplies are of high enough value in relation to their use of resources (Boe and Kvalvik, 2015).

Concluding we would like to note that according to World Bank reports (1997), 'Good government is not a luxury-it's a vital necessity for development'.

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Author's Contributions

Athanasios Vazakidis: Planned and directed the study and supervised the data analysis.

Eleftheria Kyriakidou: Carried out the implementation of the study, organized, gathered and

processed the data, performed the analysis, designed the figures and charts and wrote the manuscript in consultation with A. Vazakidis.

Both authors discussed the results and contributed to the final manuscript.

Ethics

Academic ethics were respected by the authors.

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