Suggested Model for Measuring Deviations of Resource Consumption Accounting (RCA) (Case-Study on Louran Hospital)

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Abstract

In General, we can say that the main ob-jectives to apply the activities of the costs focused on the measure of the cost in an appropriate, fair, and accurate form, achieve the control over the cost elements, and pro-vide cost information relevant to decision makers. And there are many of the writers and researchers that show up a lot of criti-cism to the ability of the traditional cost approaches [Volume approach, Activities approach (ABC), and Time Driven Activi-ties approach (TD-ABC)] to achieve these ob-jectives. As also, many studies showed the benefits of applying the Resource Con-sumption Approach (RCA) in this range where it combines the German cost acco-unting (GPK) and the activity accounting (ABC). So, According to the fundamental principles of the resource consumption ac-counting (RCA), this paper sets up a sug-gested model analyzes errors that may oc-cur during the implementation process of RCA, and conducted a case study on louran hospital .The results show that RCA devel-opment to the costs deviations system based on its new concepts, principles, and pillars makes it able to provide with accurate in-formation that express for the real devia-tions of the resources of the organization and also the efficiency of these deviations and their indicators in the judgment on the performance, the exploitation of resources, and the provision of relevant information for decision makers.

Key words: Resource consumption ac-counting, Measuring deviations, Louran Ho-spital, Determination deviation, Classifica-tion deviation.

ملخص البحث

بصفة عامة، يمكن القول بأن الأهداف الرئيسية لتطبيق أنشطة التكاليف تنصب حول قياس التكلفة بصورة ملائمة وعادلة ودقيقة ، الرقابة على عناصر التكاليف، وتوفير معلومات تكاليفية ملائمة لمتخذى القرارات. ولقد أظهر العديد من الكتاب والباحثين مجموعة من الإنتقادات نحو قدره المداخل التكاليفية التقليدية (مدخل الحجم –Volume Approach ، مدخل الأنشطة ABC ، ومدخل الأنشطة الموجه بالوقت TD-ABC) فى تحقيق تلك الأهداف. كما أظهر العديد من الدراسات جدوى تطبيق مدخل المحاسبة عــن إســتهلاك المــوارد Resource Consumption Accounting (RCA) فى هذا النطاق على اعتبار أنه يعمل على دمج محاسبة التكاليف الألمانية –Grenzplan kostenrechnung (GPK) ومحاسبة الأنشطة (ABC). فتمثل هدف البحث فى تطوير نموذج تحليل الإنحرافات عن طريق إستخدام مدخل محاسبة إستهلاك الموارد (RCA) ، وتمثلت منهجيته فى دراسة حالة على مستشفى لـوران. وأيضاً وفقاً للمبادئ الأساسية لمحاسبة إستهلاك المـوارد (RCA) فقد قدم البحث إقتراح لنموذج تحليل الأخطاء التى يمكـن أن تحـدث أثنـاء تطبيـق مـدخل محاسبة إستهلاك الموارد . وقد توصلت نتائج البحث إلى أن تطوير محاسبة إستهلاك المـوارد لنمـوذج تحليل الإنحرافات إستناداً على مفاهيمه الجديدة ، مبادئه، ركائزه جعلـه قـادر علـى تـوفير معلومات دقيقة تعبر عن الإنحرافات الفعلية لموارد المنشأة . وأيضا كفاءة تلك الإنحرافات ودلالتها بصـدد الحكم علـى تقيـيم الأداء، إسـتغلال المـوارد، وتـوفير معلومـات ملائمـة لعملية إتخاذ القرارات .

Introduction

There are deficiency aspects of the traditional cost systems for their ability to provide with accurate information that express for the real deviations of the resources of the organization and also the deficiency of the efficiency of these deviations and their indicators in the judgment on the performance, the exploitation of resources, and the provision with the relevant information for decisions making. Where the traditional systems do not take into consideration the hierarchy of the cost [The product is the only unit of analysis in this system]. Also, depending on the planned capacity as a base in the account for the rates of overhead costs, that was not isolated the costs of the unused capacity from the costs of the products (Balakrishnan et al. 2012A,b; Clinton & Van Der Merwe, 2006; Wagner,2013). In addition, to the weakness of the correlation between the real benefit of the cost objectives from the indirect elements from one hand and between the drivers of the cost used in the allocation process, where they do not reflect the real causes and effect relationships (Gupta & Gunasekaran, 2005; Rasiah, 2011). As they Identify and assign costs as innately fixed or variable at the product level, obscuring the true cost consumption patterns – as they do not recognize the patterns of cost consumption on the resource level (Clinton & Webber, 2004A). In addition, the cost approaches that depends on the volume included an aggregation error, the use of the volume as a cost driver causes a specification error, and also measurement error for their inability to isolate the idle capacity(Alhebri, 2013).

Whereas, the activity based costing system (ABC) assumed that all costs are variable, and not separate between the fixed and variable costs (Abbas & Wagdi, 2014; Keys & Van der Merwe, 2001A,C ; Stenzel & Catherine, 2008; Thomson& Gurowk, 2005; Gosselin, 2007) – it employs the practical capacity for activities to determine one allocation rate for each activity(Everaert et.al., 2008; Abbas& Wagdi, 2014; Sout &Propri,2011;Stouthuysen et.al., 2014). And this system provides cost information to support long-term decision making and it fails in determining the unused capacity of the committed resources (Grasso, 2005).

As, its dependencies on the assumption of the full allocation of the resources on the operational activities of the organization (Tse & Gong, 2009; Rahimi et.al., 2014; Thomson & Gurowka, 2005; Van der Merwe & Grasso, 2006), leads to the assignment of the idle capacity on a determined activity or add this capacity to all activities in the organization whether it was a reason for its occurrence or not (El- koumi, 2007). In addition, the depreciation is based on the historical cost (Gharouri, 2010). And there will be a difficulty in update the model because of its dependence on the allocation with percentages in the first stage not on a quantity based (Perkins & Stovall, 2011; Wegmann, 2007, 2009; Okutmus, 2015 ; Kaplan & Anderson, 2007).

On the other hand, there is a scientific debate on the determination of the cost 's behavior of the activities as an important requirement for the analysis of the deviations, as whether the costs of the activities are fixed or variable or

mixed in its relation to the driver of the activity costs as the following studies indicate(Hansen & Mowen, 2006; Mak & Roush, 1994,1996; Kaplan, 1994; Blocher et.al.,2010; Horngren et.al., 2012).

As those, that the Resource Consumption Accounting Approach (RCA) treats by its focus on the resources and its splitting of the resource costs into fixed and proportional based on their relation to the output measure of the resource pool [Notice that : it is not related to the final cost objectives of the organization like in the traditional costs allocation systems]. As this also, to separate the costs of the idle/excess capacity and not charged the consumers with costs they do not benefit from it and to apply the most important principle of the RCA – The causal principle (Rahimi et al., 2014 ; Keys & Van der Merwe, 2001A ; White, 2009,2015 ; Tse & Gong, 2009; Clinton & Webber, 2004A).

In addition, This division to fixed costs (not avoidable) and proportional costs (avoidable) is so important for Marginal/ Incremental decisions making in the short term (Clinton & Van der Merwe, 2008A,b ; Sedgley & Jackiw, 2001; CAM-I Blue Book, 2002). And also, the RCA uses the replacement cost for the depreciation of the fixed assets (Polejewski,2009 ; Grasso, 2005). As well as, it accurately expresses for the interrelationships between the resource pools, reflect the initial inherent nature of the costs, and reflects the changing of the nature of the costs through the consumption (Keys & Van der Merwe, 2001b).

Research Problem:

This research tries to answer the following questions:

1- Does the traditional system deviations analysis [Volume approach, Activities approach (ABC),Time Driven Activities approach (TD-ABC)] provides a relevant information about the measurement and the indication for the real deviations of the resources of the organization?

2- What are the principles and the pillars that distinguish the resource consumption approach from the traditional approaches for providing a relevant information about the measurement and the indication for the real deviations?

Research Importance:

The practical importance of this research:The importance of developing a model for the deviation analysis of the growing use approach in many countries – resource consumption accounting approach (RCA) – as also the requirement of the convincing and logical interpretative for the naming of the deviations.

The scientific importance of this research: The principles and the new concepts of the RCA approach and also the supposed classification of the cost to fixed and proportional require an inquiry about a new measurement for the deviations related to the resource pools and the choice of their output unit measures, and also the classification of the costs into fixed and proportional. As well as a new measurement for the deviations related to the assigned of the

costs of the resource pools to the activities then to the cost objectives.

Research Objectives:

The main objective of this research is to develop the deviations analysis system by using the resource consumption accounting approach (RCA), and in light of this main objective there are other sub- objectives as follow:

− To Illustrate the deficiency aspects of the traditional costs approaches [Volume approach, Activities approach (ABC), Time Driven Activities approach (TD-ABC)] for their ability to provide accurate information that express for the real deviations of the resources of the organization and also the deficiency of the efficiency of these deviations and their indicators in the judgment on the performance, the exploitation of resources, and the provision with relevant information for decisions making.

− To Illustrate the role of the resource consumption accounting (RCA) to avoid those deficiency aspects in the previous systems and its development to the costs deviations system based on its new concepts, principles, and pillars and also its provision to more accurate information as input in the decisions making model to do all the management roles more efficiency.

Research plan:

The first section: The criticisms of the traditional approaches deviation analysis.

The second section: The conceptual framework of the resource consumption accounting approach.

The third section: The suggested model for measuring the deviations of the resource consumption accounting.

Section 1

Many studies indicate to the deficiency aspects of the traditional volume cost approach based standard deviations analysis and argument that it should not be used for cost control and the assessment of the performance in today 's manufacturing world (Fry et.al., 1993; Cooper & Kaplan, 1988; Kaplan, 1988, 1990,1991; Johnson & Kaplan,1987; Hansen &Mowen, 2006 ; Gupta & Gunasekaran, 2005 ; Drury,1999,2009 ; Malcom,1991; Manalo, 2004; Chea, 2011; Lucas,1997; Make & Roush, 1994; Horngren et.al.,2012; Sweifery, 1999) .

As (Malcom, 1991) indicated that the traditional volume deviation analysis does not give the right control information, where the cost pools aggregate many heterogeneous resource elements and allocate the cost by using one volume based cost driver. So, the performance reports will give an inaccurate signal. And (Cooper & Kaplan, 1988) illustrated that the traditional volume deviation analysis was relevant when the variable costs were represented a big percentage of the total manufacturing costs and there was a little diversity of the products, Where there was not a difference in the requirement of the resources between the products. And also (Sweifery, 1999) directed criticism to the traditional volume devia-

tions analysis model, that it lost its indicators where the measurement process based on the activity volume expressed by the direct labor hours/costs or machine hours, that lost the real representation of the benefit correlation that correlate cost objectives by the activity performed.

Also (Kaplan,1988,1990,1991) agreed that the use of the volume based cost drivers , that differ proportionally with the units of the products, were relevance to allocate the indirect costs that proportionally consumed with the units of the products, but this allocation base will cause distortions when it used to allocate any cost of the organization that does not differ with the difference in the units of the products (e.g., differ with the number of batches or products).And also (Johnson & Kaplan, 1987) agreed that the traditional management accounting system, that focus on direct labor, that is no longer relatively important in today 's manufacturing environment, fails not only in providing the relevant information but also, in paying the attention to note the key factors of the efficiency of the production .

In addition, (Mak & Roush,1994) illustrated that with the traditional deviations analysis, there will be a problem in the explanation of the efficiency, spending, and energy utilization variances because the used allocation based does not correlate with the occurrence of the indirect cost due to the use of one volume based activity. And (Blocher et.al.,2010) discussed that the use of the traditional deviations analysis to the planned capacity instead of the theoretical or practical capacity, that hide the unused capacity by allocating it to the products, will cause the death-Spiral effect.

Whereas, (Abbas & Wagdi ,2014) illustrated that the activity based costing System (ABC) has several deficiencies : (1) It assumes full utilization of resources by activities, (2) It focuses on activities, and thus the interrelationships between resources are not identified, (3) It expands the range of variable costs by assuming cost flow from resources, through activities at different hierarchy levels, to cost objects using a single allocation rate for each activity, (4) It ignores that costs have inherent nature that is proportional or fixed. ABC also doesn't realize that the inherent nature of cost may change at point of consumption, (5) it fails to capture complexity when there are changes in operations that require adding new activities to the cost model, and (6) it is based on the practical capacity of activities. Thus, unused capacity cannot be isolated at the resource level and cannot be attributed to its resource origins**.**

And (Cooper & Kaplan, 1988; Malcom, 1991) argued that all the costs of the production are variable, some differ with the volume of the production, and others with the complexity and diversity of the production. And thus, the split of the total variance to spending and efficiency variance. While (Cooper & Kaplan, 1992) argued that the activity with fixed (committed) resources in the short term. Where they notice the importance of the distinguish between the behavior of the costs activity for the purpose of calculating the long term cost of the products and the real behavior of these costs in the short term. They argued that the activity costs are

fixed in the short term, although they are variable in the long term.

Whereas, (Mak & Roush, 1994, 1996) argued that the activity costs may be variable or fixed or mixed in the short term in its relation to the activity cost driver. And thus, the split of the total variance of the fixed activity costs to budgeting and capacity variance, while splitting the total variance of the variable activity costs to price and efficiency variance. While (Kaplan, 1994) argued that the costs of resources used by activities are fixed (committed) or variable (flexible) not the activity costs. And the cost of unused capacity must be on the resource level not on the activity level, where it represents the difference between the costs of used and committed resources. Where the assumption that the costs of resources to perform an activity are either entirely variable or fixed is not an inherent feature of activity-based cost systems.

Whereas, (Sweifery, 1999) illustrated that the variations in the activity based costing (ABC) can be explained in four kinds : (1) deviation in the determination of the drivers, (2) activity aggregation deviation, (3) Measurement deviation due to difference (over or understated) in the total indirect costs allocated to the cost pools, and (4) Measurement deviation in the units of the cost drivers allocated to the cost objectives. While (Namazi,2009) has directed several criticisms to the time-based activity costing (TD-ABC): (1)The lack of activity definition significantly deviates from major and principal fundamentals of activity-based costing, which differentiates ABC from traditional cost accounting systems, (2) TDABC determination of the capacity costs rate

can significantly diminish the system 's usefulness because the practical capacity is determined only based upon a single activity resource, and this single cost-time relationship may not represent the actual cause-effect behavior of the costs that are incurred in the department, and (3) The information generated by a TDABC system may get noisier and become less reliable because now the necessary information has to be collected from two different information sources: 1) The employees , and 2) The manager .

And also, (Labro & Cardinaels, 20-08) indicated, after performing an experiment on the determinants of Measurement Error in Time-Driven Costing, that there was a strong overestimation bias when participants provide time estimates in minutes, which may be a problematic for Time-Driven Activity-Based Costing that advocates the use of estimates in minutes. While (Alhebri,2013) illustrated that the time driven activity based costing approach (TDABC) overrides the aggregation and measurement errors resulting from the binary allocation methodology of the different cost approaches, and it is the less approach exposed to errors in costing system design special in the presence of unused fixed resources. And that the volume based costing approach includes aggregation errors due to the use of Willie Sutton rule, by designing the resource pools based on the size of the resources, and also specification errors due to the use of a volume as a cost driver. While the activity based costing (ABC) approach 's ability to override the aggregation errors in the activity pools depends on the details degree of the activities. And these two

approaches expose to measurement errors because of their inability to isolate the idle capacity. While, the resource consumption accounting (RCA) and the marginal planned cost (GPK) approaches override the aggregation error through the dependence on the resource correlation rule in determining the resource pools, while the marginal planned cost approach exposes to specification errors when the output measures of the resource pool were unable to illustrate the resource consumption relationships, and RCA overrides that by adding the activity drivers in its cost model. And about the measurement errors, it may be rare to occur in these two approaches due to their ability in isolating the cost of idle capacity when determining the rates of the cost drivers.

Section 2

In 2001 Keys and Van der Merwe (A,b,C) Indicated that the Resource consumption accounting effectively addresses all the shortfalls of the ABC perspectives on resources by: (1) Providing the resource output measure as a consistent and uniform measure of resource capacity, (2) Reflecting resource element interrelationships in homogeneous resource pools, (3) Consistently accommodating the initial inherent nature of cost in primary cost elements and resource output cost rates and correctly reflecting the nature of cost within in a process, (4) Accurately accounting for short- to medium-term fluctuations in capacity use and delineating the excess and idle capacity variance where it is visible and actionable by management, (5)Accurately expressing resource interrelationships by reflecting causal relationships in resource output quanti-

ties, (6) Accommodating the changing nature of cost at the time of consumption in secondary cost elements and in a quantity based simultaneous model, (7) Providing fully burdened resources costs that are superior in product cost accuracy and in decision support for making outsourcing decisions, and (8) Unambiguously tying the nature of cost to the strategic timeframe and objectives of the enterprise and accommodating the different demands for operational, tactical and strategic decision support effectively through a single source of information .

Whereas, (Ahmed & Moosa,2011) illustrated that the Resources Consumption Accounting (RCA) combines German management accounting methods known as "Grenzplankostenrechnung" or GPK which means "flexible cost planning and control" and strict form of Activity-Based Costing (ABC) for detailed process insights. RCA creates an integrated economic model of operations by breaking down the capacity of resources into productive capacity resource, non-productive capacity resource and idle capacity resource. RCA follows *the principles of causality, responsiveness and work* for modeling resource consumption and costs.

So (White,2009) indicated that the Resources Consumption Accounting (RCA) is based on three pillars: *(1) Pillar 1: Focus on Resources and Their Consumption,(2) Pillar 2: Quantity Structure for Resource Consumption , and (3) Pillar 3: Recognizing the Inherent and Changing Nature of Costs* [Resource pools start with an inherent cost structure, and as resources are consumed, the nature of their costs changes. Costs that are initially proportional

by nature can change from proportional to *fixed* based on consumption patterns]. The RCA model can be complex, but it needs to reflect the reality of the resource flows in the organization without arbitrary allocations not based on cause and effect, where the relevant term for a purely causal-based cost of a final unit of product or service is the *attributable cost*.

Whereas, (CAM-I Blue Book , 20-02) explained some concepts that the Resources Consumption Accounting (RCA) used : *Proportional Consumption* [Input quantities required to achieve a managerial objective, which vary (e.g., according to a linear relationship) with the objective's level of output]. *Proportional Cost Rate*   [Proportional costs of proportional input units of an objective divided by its output]. *Proportional Costs* [Proportional consumption of inputs times their proportional cost rate]. *Fixed Consumption* [Input quantities required to achieve a managerial objective, which do not vary with the objective's level of output within the relevant range]. *Fixed Cost Rate* [Total costs of fixed input units of an objective divided by its capacity, plus the fixed costs of the proportional input units of an objective divided by its output]. *Fixed Costs* [Total costs of fixed input units of an objective plus the fixed costs of the proportional input units of an objective]. *Primary Costs* [Costs for inputs to a managerial objective sourced external to the enterprise; are typically (but not necessarily e.g., depreciation) indicative of cash outflows]. And *Secondary Costs* [Costs for inputs consumed, by a managerial objective, from internal support functions].

On the other hand, (Clinton & Webber,2004b) explained the formulas for determining proportional and fixed cost:(1) Proportional Cost Assigned = PCQ * PR, (2) Total Fixed Cost Assigned = (FQC*FR) +(FQC *PR) + (PQC * FR) . Where, **PR**—Proportional budgeted rate for a resource provided by the support department, **FR**—Fixed budgeted rate for a resource provided by the support department, **PQC**—Proportional quantity of a resource consumed by the receiving sample department, and **FQC**—Fixed quantity of a resource consumed by the receiving sample department. Thus, RCA recognizes the principle that once a cost is fixed, it remains fixed. A proportional cost, however, can change to fixed based on the way output is consumed. Thus, the consuming receiver of the cost can consume a resource that originally was a proportional cost (e.g., to the support department) in a fixed manner.

While(Keys & Van der Merwe, 2002) illustrated that Effective organizational control is the timely measurement of actual results against a relevant benchmark to obtain information on performance and deviations for corrective action. And the best way to achieve this is by leveraging the superior qualities of a cost model based on RCA principles— recognition of management tiers, quantity-based definition of causal relationships with unit standards, and RCA 's view of the nature of cost. A system based on RCA principles provides the following control mechanisms: (1) Management planning and control tiers and their objects [the resource tier, the value chain tier, the product/service tier, and the results tier], (2) Authorized report-

ing [Authorized cost or authorized prof-it would be the cost/profit that should have been achieved given actual output levels and standard costs/prices. The word "authorized" is used in the sense that costs are approved to the new (cal-culated) level as opposed to the original (static) level of the budget, where vari-ances in RCA are always calculated between authorized and actual costs/ profits], (3) A reflective view of opera-tions, and (4) Extensive variance analy-sis [The ability to provide input- and output-side variances and a clear delin-eation of controllable and uncontrolla-ble variances to each management tiers, and Effective organizational learning].

Thus, from the literature review, this paper investigates the distinguishing features of the resource consumption accounting (RCA), and how it address-es all the shortfalls of the previous cost approaches. Where its development to the costs deviations system based on its new concepts, principles, and pillars makes it able to provide with accurate information that express for the real deviations of the resources of the organ-ization and also the efficiency of these deviations and their indicators in the judgment on the performance, the ex-ploitation of resources, and the pro-vision of relevant information for deci-sion maker. And we will apply the re-source consumption accounting vari-ance analysis on louran hospital. And in the following section we will introduce a suggested model for measuring devia-tions of RCA due to the errors in the costing system.

Section 3

The suggested model for measuring the deviations of the resource consump-tion accounting (RCA) :

First:on the resource pool level

We can say that the total error in the costing system on resource pool's level that can occur in the indirect overhead cost assigned to the cost objective (q), Which symbolized by $[T E_q \ " C S \ "]$, can be explained into **five** kinds are [as figure 1 show] :

(1) **Specification deviation (S E $_q$" C S "):**due to the choosing of wrong assigned base. Where the specifica-tion error arises when the method used to identify costs to products do-es not reflect the demands placed on resources by individual products (Labro & Vanhoucke,2007). And th-is error can occur 3 times in the re-source pool :

(a) When choosing the wrong output measure to the resource pool [and so choosing the wrong output measure to calculate the Fixed rate for fixed consumption [(Total primary fixed costs + Total secondary fixed costs for fixed consumption) ÷ Theoreti-cal capacity] , Fixed rate for propor-tional consumption [Total secondary fixed costs for proportional con-sumption÷ planned capacity], and Proportional rate [Total primary and secondary proportional costs ÷ pla-

nned capacity]. And if we symbolized the total cost assigned to the cost objective (q) in the optimum costing system by $[TC_q \, "CS*"]$, and also symbolized the total cost assigned to the cost objective (q) with the wrong choice of the output measure of the resource pool by $[TC_q \, "CS_1"]$, so

$$SE_q \, "CS1" = TC_q \, "CS*" \_\_ TC_q \, "CS_1"... (1)$$

(b) When choosing the wrong activity drivers and/or output measures of resource pools to calculate the secondary costs of the resource pool . And if we symbolized the total cost assigned to the cost objective (q) with the wrong choice of activity drivers and/or output measures of the secondary quantities consumed by $[TC_q \, "CS_2"]$, so

$$SE_q \, "CS_2" = TC_q \, "CS_1" \_\_ TC_q \, "CS_2"... (2)$$

(c) When choosing the wrong output measure for calculating the rates of the resource pool [Fixed rate for fixed consumption, Fixed rate for proportional consumption, and Proportional rate]. And if we symbolized the total cost assigned to the cost objective (q) with the wrong choice of output measure for calculating the rates of the resource pool by $[TC_q \, "CS_3"]$, so

$$SE_q \, "CS3" = TC_q \, "CS2" \_\_ TC_q \, "CS3... (3)$$

(2) Aggregation deviation (AE_q " CS "): due to aggregate unrelated resource elements in one resource po-ol, and continue using the same output measure used in the previous costing system. And this error can occur 2 times in the resource pool:

(a) When aggregating unrelated primary resource elements. And if we symbolized the total cost assigned to the cost objective (q) with the aggregate primary resource elements, and also unfair activity drivers/output measures(Specification deviation) by $[TC_q "CS_4"]$, so
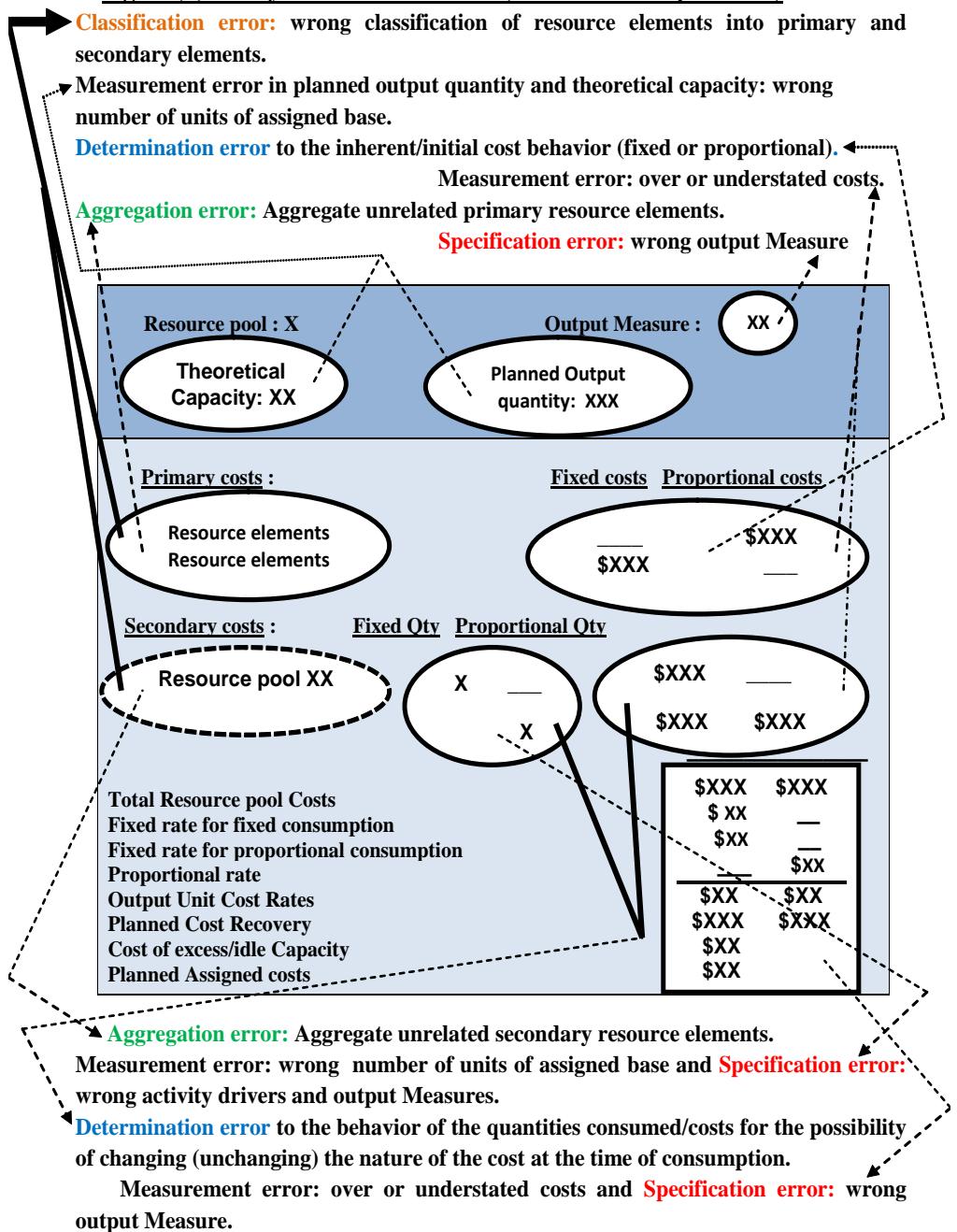
$$AE_q \, "CS1" = TC_q \, "CS3" \_\_ TC_q \, "CS4"....(4)$$

(b) When aggregating unrelated secondary resource elements. And if we symbolized the total cost assigned to the cost objective (q) with the aggregate of unrelated primary and secondary resource elements, and also unfair activity drivers/output measures (Specification deviation) by $TC_q "CS_5"$], so

$$AE_q \, "CS2" = TC_q \, "CS4" \_\_ TC_q \, "CS5"...(5)$$

(3)Measurement deviation (M E_q " CS "): There are **two** kinds :

- Measurement deviation due to the difference in the total overhead cost assigned to the cost pools (over or understate). And this error can occur 2 times in the resource pool :

Figure (1): Analysis of errors for RCA (on the resource pool level)

Classification error: wrong classification of resource elements into primary and secondary elements.

Measurement error in planned output quantity and theoretical capacity: wrong number of units of assigned base.

Determination error to the inherent/initial cost behavior (fixed or proportional).

Measurement error: over or understated costs.

Aggregation error: Aggregate unrelated primary resource elements.

Specification error: wrong output Measure

Resource pool : X	**Output Measure :** XX
Theoretical Capacity: XX	Planned Output quantity: XXX

Primary costs :   **Fixed costs   Proportional costs**

Resource elements
Resource elements

____ $XXX
$XXX   ___

Secondary costs :   **Fixed Qty   Proportional Qty**

Resource pool XX

X   ___

X

$XXX   ___
$XXX $XXX

$XXX	$XXX
$ XX	—
$XX	—
	$XX
$XX	$XX
$XXX	$XXX
$XX	
$XX	

Total Resource pool Costs
Fixed rate for fixed consumption
Fixed rate for proportional consumption
Proportional rate
Output Unit Cost Rates
Planned Cost Recovery
Cost of excess/idle Capacity
Planned Assigned costs

Aggregation error: Aggregate unrelated secondary resource elements.

Measurement error: wrong number of units of assigned base and **Specification error:** wrong activity drivers and output Measures.

Determination error to the behavior of the quantities consumed/costs for the possibility of changing (unchanging) the nature of the cost at the time of consumption.

Measurement error: over or understated costs and Specification error: wrong output Measure.

[Prepared by the researcher]

(a) When there is over/under costs to the primary costs [Notice that: There will be also measurement errors when calculating the authorized costs for analysis variance] and/or the secondary costs. And if we symbolized the total cost assigned to the cost objective (q) with deviation due to the difference in the total overhead cost assigned, aggregation deviation, and also Specification deviation by [$TC_q "CS_6"$], so

$$M E_q "C S_1" = T C_q "C S_5" \_\_ T C_q "C S_6" \dots (6)$$

(b) When there is over/under costs when calculating the total costs of the resource pool. And so, measurement errors when calculating the rates of the unit output measure of the resource pool [Fixed rate for fixed consumption, Fixed rate for proportional consumption, and Proportional rate], measurement errors when calculating planned/actual cost recovery, measurement errors when calculating planned/actual excess/ idle capacity, and also measurement errors when determining the over/ under absorption cost. And if we symbolized the total cost assigned to the cost objective (q) with deviation due to the difference in the total overhead cost assigned, aggregation deviation, and also Specification deviation by [$TC_q "CS_7"$], so

$$M E_q "C S2" = T C_q "C S 6" \_\_ T C_q "C S 7" \dots (7)$$

- Measurement deviation in the units of cost drivers (activity drivers and/or output measures) assigned to the cost objectives. And this error can occur 2 times in the resource pool :

(a) Wrong number of units of assigned base of the planned/actual output measure and/or the theoretical capacity [Notice that: There will be also measurement errors when calculating the authorized quantity/costs for analysis variances]. And if we symbolized the total cost assigned to the cost objective (q) with aggregation deviation, Specification deviation, and also Measurement deviation due to the difference in the total overhead cost assigned and/or in the units of output measures by [$TC_q "CS_8"$], so

$$M E_q "C S3" = T C_q "C S 7" \_\_ T C_q "C S 8" \dots (8)$$

(b) Wrong number of units of assigned base of the fixed/ proportional secondary quantities consumed [Notice that : There will be also measurement errors when calculating the authorized quantity/costs for analysis variances]. And if we symbolized the total cost assigned to the cost objective (q) with aggregation deviation, Specification deviation, and also Measurement deviation due to the difference in the total overhead cost assigned and/or in the units of cost drivers by [$TC_q "CS_9"$], so

$$M E_q "C S4" = T C_q "C S 8" \_\_ C_q "C S 9" \dots (9)$$

(4) Determination deviation ($D E_q "C S"$): due to the wrong determine of the inherent/initial cost behavior (fixed or proportional) of the primary costs. And also, wrong determine of the behavior of the quantities consumed / secondary costs for

the possibility of changing (unch-anging) the nature of the cost at the time of consumption. And this error can occur 3 times in the resource pool:

(a) When determining the inherent / initial cost behavior (fixed or pro-portional) of the primary costs [No-tice: There will be also determina-tion error of the cost behavior when calculating the primary authorized costs for analysis variance]. And if we symbolized the total cost as-signed to the cost objective (q) with aggregation deviation, Specification deviation, Measurement deviation due to the difference in the total ov-erhead cost assigned and/or in the units of cost drivers, and also deter-mination error by [$TC_q "CS_{10}"$], so

$$D E_q "C S_1" = T C_q "C S_9" \_\_ T C_q "C S_{10}"...(10)$$

(b) When determining the behavior of the secondary quantities consumed from other resource pool/activities. Where occurring wrong determina-tion of the behavior of the quantities consumed, cause wrong determina-tion of the behavior of the secondary costs [And also, the wrong determi-nation of   the behavior of the sec-ondary authorized quantities / costs] . Where the secondary fixed quanti-ties consumed have only fixed cost because of the change of the nature of the proportional cost to fixed. W-hile, the proportional quantities con-sumed have fixed and proportional costs because of the non changing nature of the fixed cost. And if we symbolized the total cost assigned to the cost objective (q) with aggrega-tion deviation, Specification devia-

tion, Measurement deviation due to the difference in the total overhead cost assigned and/or in the units of cost drivers, and also a determina-tion deviation to the inherent/initial cost behavior and/or to the behavior of   the secondary quantities con-sumed by [$TC_q "CS_{11}"$], so

$$D E_q "C S2" = T C_q "C S 10" \_\_ T C_q "C S 11".. (11)$$

(c) When determining the behavior of the secondary costs of the second-ary quantities consumed for the pos-sibility of changing (unchanging) the nature of the cost at the time of consumption. And if we symbolized the total cost assigned to the cost ob-jective (q) with aggregation devia-tion, Specification deviation, Meas-urement deviation due to the differ-ence in the total overhead cost as-signed and/or in the units of cost drivers, and also a determination de-viation to the inherent/initial cost behavior and/or to the behavior of the secondary quantities consumed /costs for the possibility of changing (unchanging) the nature of the cost at the time of consumption by [$TC_q "CS_{12}"$], so

$$D E q "C S3" = T C q "C S 11" \_ T C q "C S _{12}"....(12)$$

(5)Classification deviation ($C E_q "C S "$): due to errors in the classifi-cation of resource elements into primary and secondary elements. And if we symbolized the total cost assign-ned to the cost objective (q) with ag-gregation deviation, Speci-fication deviation, Measurement de-viation due to the difference in the

total ov-erhead cost assigned and/or in the units of cost drivers, determination deviation, and classification deviation by [TC $_q$"CS$_{13}$"], so

C E q "C S" =T C q "C S 12"__T C q "C S 13".(13)

-And the model can gain a bigger ability for analysis through the measurement of the total deviation in the overhead cost assigned to the cost objective (q) through the comparison between the overhead cost assigned in the optimum costing system, which is free from the five kinds of deviations, and similar costs with the occurrence of the five kinds of deviations, so

T E q "C S" = T C q " C S * "__ T C q "C S 13".. (14)

-And also, we can analysis this total deviation into its 13 components:

T E q " C S " = S E q " C S1" + S E q " C S2" + S E q " C S3" + A E q " C S1" + A E q " C S2" + M E q " C S1" + M E q " C S2" + M E q " C S3" + M E q " C S4" + D E q " C S1" + D E q " C S2" + D E q " C S3" + C E q " C S " …….. (15)

Second: on the Activites level

We can say that the total error in the costing system on activity 's level that can occur in the indirect overhead cost assigned to the cost objective (q),Which symbolized by [T E $_q$ " CS "], can be explained into **five** kinds are [as figure 2 show] :

(1) Specification deviation (S E $_q$ " C S "):due to the choosing of the wrong assigned base. And this error can occur 2 times in the activity :

(a) When choosing the wrong activity drivers. And if we symbolized the total cost assigned to the cost objective (q) in the optimum costing system by [T C $_q$"CS *"], and also symbolized the total cost assigned to the cost objective (q) with the wrong choice of the activity drivers by [T C $_q$" C S $_1$"], so

S E q "C S1" = T C q " C S * "__ T C q "C S $_1$"... (1)

(b)When choosing the wrong output measures of the consuming resource pools for calculating the secondary costs of the activities. And if we symbolized the total cost assigned to the cost objective (q) with the wrong choice of activity drivers and/or output measures of the secondary quantities consumed by [T C $_q$"C S $_2$ "], so
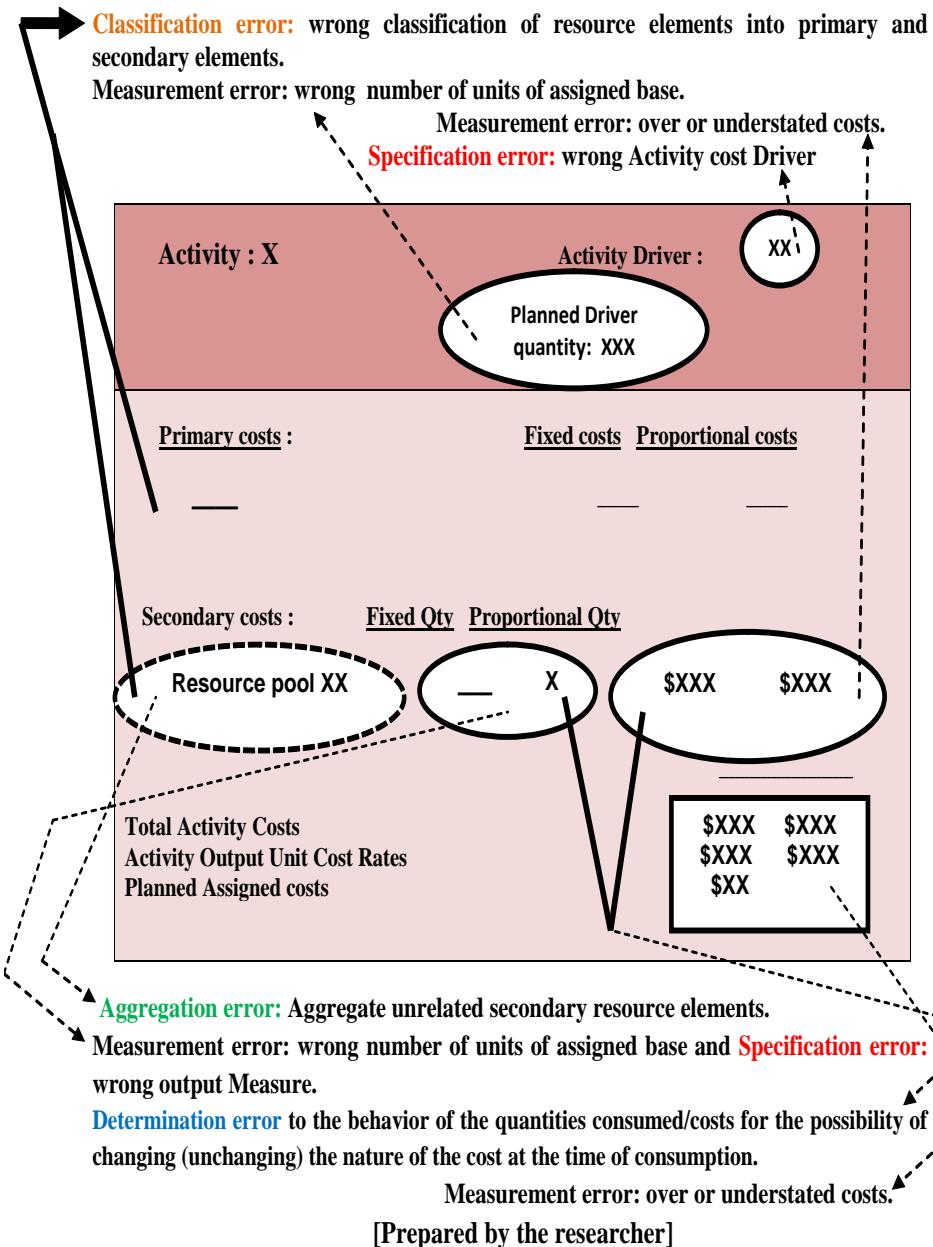
S E q "C S2" = T C q "C S 1"__T C q "C S 2…(2)

(2) Aggregation deviation (A E $_q$ " C S "): due to aggregate other secondary resource elements other than the resource that perform the activity. Thus, this error can occur when aggregating unrelated secondary resource elements[Where every activity consumes the output of one resource pool (the resource that perform the activity)]. And if we symbolized the total cost assigned to the cost objective (q) with the aggregate of unrelated secondary resource el-

ements, and also unfair activity dr-
ivers/output measures (Specification
deviation) by [TC $_q$"CS$_3$"], so

$$A E q \ "C S" = T C q \ "C S 2" \_ T C q \ "C S 3" .... (3)$$

Figure (2): Analysis of errors for RCA (on the activity level)

Classification error: wrong classification of resource elements into primary and secondary elements.
Measurement error: wrong number of units of assigned base.

Measurement error: over or understated costs.
Specification error: wrong Activity cost Driver

Activity : X   Activity Driver :   **XX**

Planned Driver
quantity: XXX

Primary costs :   **Fixed costs Proportional costs**

___   ___   ___

Secondary costs :   **Fixed Qty Proportional Qty**

Resource pool XX   ___   X $XXX $XXX

Total Activity Costs
Activity Output Unit Cost Rates
Planned Assigned costs

$XXX $XXX
$XXX $XXX
$XX

Aggregation error: Aggregate unrelated secondary resource elements.
Measurement error: wrong number of units of assigned base and **Specification error:** wrong output Measure.
Determination error to the behavior of the quantities consumed/costs for the possibility of changing (unchanging) the nature of the cost at the time of consumption.
                    Measurement error: over or understated costs.
        [Prepared by the researcher]

(3)Measurement deviation (M E$_q$" C S "): There are **two** kinds :

- Measurement deviation due to the difference in the total overhead cost assigned to cost pools (over or understate). And this error can occur 2 times in the activities :

(a)When there is over/under costs when calculating the secondary costs of the activities. And thus, measurement errors when calculating the activity output unit cost rates (the fixed and proportional rates) [Notice that: There will be also measurement errors when calculating the planned assigned costs and the assigned costs based on the actual quantity of the activity driver]. And if we symbolized the total cost assigned to the cost objective (q) with deviation in the total overhead cost assigned, Specification deviation, and also an aggregation deviation by [TC $_q$"CS-$_4$"], so

$$M E_q \text{ "C S}_1\text{" } = T C_q \text{ "C S}_3\text{"} \_ T C_q \text{ "C S}_4\text{"...(4)}$$

(b)When there is over/under costs when calculating the total costs of the activity. And so, measurement errors when calculating the output unit cost rates of the activity (the fixed and proportional rates), and the planned/ authorized assigned costs. And if we symbolized the total cost assigned to the cost objective (q) with Measurement deviation, Specification, and also an aggregation deviation by [TC $_q$"CS$_5$"], so

$$M E_q \text{ "C S}_2\text{" } = T C_q \text{ "C S}_4\text{" } \_ T C_q \text{ "C S}_5\text{"... (5)}$$

-Measurement deviation in the units of cost drivers (activity drivers and/or output measures) assigned to the cost objectives. And this error can occur 2 times in the activities :

(a) Wrong number of units of assigned base of the activity driver [Notice that: There will be also measurement errors when calculating the authorized quantity/costs for analysis variances]. And if we symbolized the total cost assigned to the cost objective (q) with Specification deviation, aggregation deviation, and also a Measurement deviation in the total overhead cost assigned and/or in the units of the activity driver by [TC $_q$"CS$_6$"], so

$$M E_q\text{"C S3" } = T C_q \text{ "C S 5"} \_ T C_q \text{ "C S 6".. (6)}$$

(b) Wrong number of units of assigned base of the proportional secondary

quantities consumed [Notice that : There will be also measurement errors when calculating the authorized quantity/costs for analysis variances]. And if we symbolized the total cost assigned to the cost objective (q) with Specification deviation, aggregation deviation, and also a Measurement deviation in the total overhead cost assigned and/or in the units of cost drivers by [TC $_q$"CS$_7$"], so

$$M E_q\text{ "C S4" } = T C_q \text{ "C S 6"} \_ T C_q \text{ "C S}_7\text{" ... (7)}$$

(4)Determination deviation (D E $_q$" C S "): due to the wrong determine of the behavior of the quantities consumed / secondary costs for the possibility of changing (un-

changing) the nature of the cost at the time of consumption. And this error can occur 2 times in the activities:

(a) When determining the behavior of the secondary quantities consumed from the resource pools. Where occurring wrong determination of the behavior of the quantities consumed, cause wrong determination of the behavior of the secondary costs[And also, the wrong determination of the behavior of the secondary authorized quantities /costs].Where the secondary quantities consumed by the activities is a proportional quantity to the activity driver, and so having fixed and proportional costs because of the non changing nature of the fixed cost. And if we symbolized the total cost assigned to the cost objective (q) with aggregation deviation, Specification deviation, Measurement deviation due to the difference in the total overhead cost assigned and/or in the units of cost drivers, and also a determination deviation to the behavior of the secondary quantities consumed by [TC $_q$"CS$_8$"], so

$$\mathbf{D\,E\,q\,\text{"}C\,S1\text{"} = T\,C\,q\,\text{"}C\,S\,7\text{"}\_\_T\,C\,q\,\text{"}C\,S\,8\text{"}..\ (8)}$$

(b) When determining the behavior of the secondary costs of the secondary quantities consumed for the possibility of changing (unchanging) the nature of the cost at the time of consumption. And if we symbolized the total cost assigned to the cost objective (q) with aggregation deviation, Specification deviation, Measurement deviation due to the difference in the total overhead cost assigned and/or in the units of cost drivers, and also a determination deviation to the behavior of the secondary quantities consumed/costs for the possibility of changing (unchanging) the nature of the cost at the time of consumption by [TC $_q$" CS$_9$"], so

$$\mathbf{D\,E\,q\,\text{"}C\,S2\text{"} = T\,C\,q\,\text{"}C\,S\,8\text{"}\_\_\,T\,C\,q\,\text{"}C\,S\,9..\ (9)}$$

(5)Classification deviation (C E $_q$" C S ") : due to errors in the classification of resource elements into primary and secondary elements. And if we symbolized the total cost assigned to the cost objective (q) with aggregation deviation, Specification deviation, Measurement deviation due to the difference in the total ov-erhead cost assigned and/or in the units of cost drivers, determination deviation, and classification deviation by [TC $_q$"CS$_{10}$"], so

$$\mathbf{C\,E\,q\text{"}C\,S\text{"} = TC\,q\,\text{"}C\,S\,9\text{"}\_T\,C\,q\text{"}C\,S\,10\ldots(10)}$$

- So, the model can gain a bigger ability for analysis through the measurement of the total deviation in the overhead cost assigned to the cost objective (q) through the comparison between the overhead cost assigned in the optimum costing system, which is free from the five kinds of deviations, and similar costs with the occurrence of the five kinds of deviations, so

$$\mathbf{T\,E\,q\,\text{"}C\,S\text{"} = T\,C\,q\text{"}\,C\,S\,*\,\text{"}\_\_T\,C\,q\text{"}C\,S\,10\text{"}..\ (11)}$$

- So also, we can analysis this total deviation into its 10 components:

$$T E q " C S " = S E q " C S1" + S E q " C S2" + A E q " C S " + M E q " C S1" + M E q " C S2 " + M E q " C S3" + M E q " C S4 " + D E q " C S1 " + D E q " C S2" + C E q " C S " ..... (12)$$

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