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FEASIBILITY STUDY FOR IMPLEMENTATION OF AN ACTIVITY- BASED COSTING SYSTEM (ABCS) IN ALLOY STEEL INDUSTRIES (ASI)

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ABSTRACT

Precise appraisal of products and submission of suitable reports for decision-making is the goal of a costing system. Therefore, one of the concerns of steel industry is providing finished price to remove the weaknesses of absorptive costing system and providing proper information to access an integral quality. In fact, this system is one of the powerful and suitable tools for companies to access their goals and to preserve their competitive power. This paper studies the effective factors for a feasibility study for implementation of an activity-based costing system (ABCS) in alloy steel industries of Iran. The factors that deviate finished price in absorptive costing are: high production overload, production complexities, production diverse, volume diverse, production physical size diverse, complexity of raw materials, high inventory of finished semi-finished products at the end of period, and recognition of cost storages and cost-creation factors. Survey method was used to gather data including library, interview, and questionnaire. T Test was used to confirm or reject the assumptions. It was found that implementation of an activity-based costing system is feasible in ASI.

KEYWORDS

Activity-based costing, management accounting, product-level activities.

INTRODUCTION

Steel industry is a mother industry in country. Researchers believe that development is not possible without steel industry. Events such as world competition development, IT development, access to information systems during last two decades, and efforts of economic agents to meet world ranks and to enter into international markets necessitate views such as customer satisfaction and activity-based management.

Also, by increment of technology and other overload costs shares on production and services, traditional costing methods are obsoleted, while data for finished prices of products, services and customers are the most important one in financial information. Inefficiency of information by traditional costing systems has directed economic units toward activity-based costing system (ABCS). ABCS is one of the modern costing systems for products and services with capabilities such as calculation of finished price, improvement of production process, removal of abandoned activities, recognition of cost motives, operational planning, and determination of commercial strategies for an economic unit. This system concerns with cost and production creation reasons instead of concerning with effects, and if an activity is not justifiable, it will be removed, adjusted, or improved. Despite innovation of new methods in production styles and tools, costing systems are ever criticized. By a short review of the literature of management accounting and ABC, we try to identify the effective factors on implementation of ABC in ASI.

PROBLEM EXPRESSION

Companies have no other way to accompany with rapid changes of technology, so they try to use modern methods to improve their business quality and to control finished prices of their products. In this situation, companies are going to change their information systems and removal of traditional systems. Competition implies control of costs. Here, we study absorptive costing method. Regarding to diversity of products and processes, and regarding to sever competition in steel market, this method cannot respond information needs of managers. Now, we ask "Is it possible to use ABCS regarding diversity of activities, cost structures, production processes, and products?"

GOAL OF RESEARCH

One of the main goals of finished price accounting system (FPAS) is providing proper information for finished prices of products. If a trade unit has its production costs, it can concentrate on the most profitable activities and avoid non-profitable ones.

Available costing systems have weaknesses, because they report finished prices improperly when there are diverse products. ABC determines costs precisely. The strategic goal of this system is providing suitable information for costs and profits for better decision-making about prices, production combinations, and improvement of operations. The main goal of this research is "Feasibility study for implementation of an activity-based costing system (ABCS) in Alloy Steel Industries (ASI)".

TABLE 1: ASSUMPTIONS

Main assumption	Implementation of ABCS in ASI is feasible.
Sub-main assumption 1	Overload production share is high in ASI.
Sub-main assumption 2	There is production complexity in ASI.
Sub-main assumption 3	There is production diversity in ASI.
Sub-main assumption 4	There is production volume diversity in ASI.
Sub-main assumption 5	There is products' physical size diversity in ASI.
Sub-main assumption 6	There is raw material complexity in ASI.
Sub-main assumption 7	Inventory of finished and semi-finished products is high in ASI.
Sub-main assumption 8	Cost storage and cost-producing factors can be recognized in ASI.

THEORETICAL FUNDAMENTALS AND ACCOUNTING INFORMATION SYSTEM (AIS)

In practice, all organizations have AIS. These systems are similar in three cases: structures, processes, and goals. These items are more complex in production companies. Generally, accounting is recognition, measurement, recording, classification, and reduction of financial effects of transactions, operations, activities, and other conditions of financial events affecting on an economic unit and converting this data to comprehensive reports for beneficiaries and decision-makers. Accounting is the art of interpretation, measurement, and transferring the results of economic activities and operations. Accounting is the language of trade. Expressions like asset, debt, net profit, cash fund circulation, and share profit are common in accounting.

The goals of AIS can be used to:

1. Determine major strategies and long term planning
2. Make decisions about resource assignment
3. Plan and control financial reporting
4. Measure performances of staff

CALCULATION OF FINISHED PRICE PROCESS IN TRADITIONAL SYSTEMS AND ITS FAULTS

Improvement of production technology and changes of management thought for inventory, on-time production, and other factors have severely modified product costs structures and have increased overload costs and decreased direct and raw material costs.

In traditional systems, often direct labor cost is used to assign overload cost. While today, direct labor cost mostly include less than 15% and overload costs include more than 50% of product costs.

Therefore, assignment of overload costs up on direct labor hours conclude incorrect calculation of finished price.

In traditional system, finished price is calculated as follows:

1. Assignment of direct materials and direct remuneration to products and services
2. Assignment of overload costs to products and services by a certain absorption rate
3. Calculation of finished price

Disadvantages of this system are:

1. Direct labor cost has no value any more.
2. Usage of a certain assignment rate cannot show all relations between costs.
3. Despite high share of overload cost in product cost, its assignment method is not important.
4. This system does not respond in complex and unusual production processes.
5. This system does not provide proper and real information for finished price and profitability.

To overcome these faults, many companies have gravitated toward ABCS. This system does not replace order costing of step-by-step method, but it can be used in parallel of them. ABCS includes modern philosophy of managers (customer satisfaction) and competition in product costing quantitatively. Namely, rather than costs of direct material and direct remuneration, this system includes technology costs, product quality costs, and flexible production costs, too.

ACTIVITY BASED COSTING SYSTEM OVERVIEW AND BACKGROUND

In late of 1960s and early of 1970s, some writers pointed to the relation between activity and cost. However, in 1980, following reflection of weaknesses and deficiencies of common accounting systems to report cost information, universities noticed to this relation much more. This notice was based on three main structures:

1. **Structure 1:** Modern changes to introduce modern production technologies and mechanisms in different countries such as Japan,...
2. **Structure 2:** Mental philosophies of many company managers have largely changed in 1980s, and rather than profitability, international competition, customer satisfaction, quality control, and cost decrement also were added to their goals.
3. **Structure 3:** Many accounting writers proceeded to describe new production space, different roles of technology, and new views of managers. These writers claimed that not only traditional systems of industrial accounting could not respond needs of managers, but also their output might deviate managers. (Oava, 2002)[1]. Then, those writers introduced a new system called "Activity-based Costing System".

ABC/M is a two-stage process, (1) associating cost to resource (activity), and (2) selecting an appropriate activity measurement (activity cost driver), [2]. Kee[3] named the two steps as; (1) breaking overhead costs into different cost pools and (2) assigning overhead costs through different activity cost drivers to products or orders. As a result, a more accurate overhead costs assignment is achieved. ABC/M supporters highlight two principal objectives, [4] and [5]: (1) to provide detailed information about the costs and consumption of activities in a specific process and (2) to provide accurate information for managers to improve decisions. This has also been corroborated by Gosselin[6] regarding a pilot and full ABC/M implementation studies. However, the use of ABC/M has been limited to a cost accounting approach, rather than as a managerial technique (Gosselin[6]; Kaplan and Anderson [7]; Gosseling[8]). ABC/M advantages, and constructive effects, on a firm's performance have been determined through numerous studies and dissertations. Kennedy and Afleck-Graves [9], Ittner et al. [10], and Cagwin and Bouwman[11] attested ABC/M as a preferable accounting approach compared to the TCA systems. Some studies such as; Novičević and Antić[12] and Cagwin and Barker [13] showed evidence of a positive impact of ABC/M on lean manufacturing components like Just-In-Time (JIT) and Total Quality Management (TQM). The preeminence of ABC/M in providing detailed cost information represents a potential powerful approach for developing PTP Supply Chain Decision Support Systems. Malik and Sullivan [14] developed an ABC/M-based Mixed-Integer Programming (MIP) decision support model for product mix problems. Kee[3] integrated some aspects of the Theory of Constraints (TOC) in ABC/M-based MIP modeling for the product mix problem and named it "Expanded ABC/M model." The model identifies the firm's optimal product mix by evaluating simultaneously the resources and product cost, the production resources availability, and the business marketing opportunities. In Supply Chain Order Management, [15] and [16] presented a PTP- MIP model for accepting or rejecting orders by implementing ABC/M homogeneous cost pools' structure originally introduced by Cooper and Kaplan [2]. The purpose of the model was to gain insight into how significant Order Management decisions are in maximizing profitability when the firm has insufficient production resources to satisfy all the demand. Khataie et al. [17] added the possibility of pursuing two main different goals simultaneously, reducing the residual capacity and increasing the profitability to the previous models. A powerful PTP Order Management tool assists management to monitor, analyze, and foresee the consequences and outcomes of each decision, and monitors their business competitiveness factors dynamically.

WHICH COMPANIES SHOULD USE ABCS?

Using ABCS is not suitable for some companies and is ineffective for some others. ABC is suitable for companies with the following features:

1. Companies with different products and services.
2. Companies with high overload costs, so that these costs cannot be assigned their products equally.
3. Companies that use automatic machinery in production.
4. Companies with complex and unusual production processes.

CLASSIFICATION OF COSTS IN ABCS

1. Unit-level activities: which one unit is produced in each production step;
2. Batch-level activities: which one batch is produced in each production step;
3. Product-level activities: which different products are produced by supply;
4. Factory-level activities: which support general production process of factory.

The first three levels deal with those costs that can be assigned to products directly. However, the first level includes common costs for products and they can be divided between products optionally (e.g. lighting and cleaning costs).

ABCS is a modern phenomenon that has developed traditional costing thought in management accounting and has attracted notices of many economic units. Some of advantages of this system are:

1. Improvement of costing system and better assignment of costs
2. Determination of finished price and pricing more precisely and logically
3. Control of operations and better planning
4. Better evaluation of financial operations of managers
5. Removal of none value-added activities

Despite these advantages, today only scientific communities contribute ABCS and factories and industries have not contributed to it so much. Its reason is unfamiliarity of managers, industries, and related personnel and fear of costs of implementation of this system.

ABC IN ASI

ASI has a special place as one of the economic development branches between industries. This industry plays an important role in manufacturing of industrial parts. Products of this industry in country compete with similar external products.

The nature of this industry increases complexity of decisions by its structure and shape and its capital-consuming nature. Usage of suitable methods follows cost-saving and prevents incorrect decisions and methods.

Progressive trend of orders in internal and external markets have made it inevitable to move toward optimization of activities with high qualities and low prices. Therefore, necessity of using modern techniques is understood regarding the above mentioned conditions in industries of Iran and the concepts of ABCS. As mentioned before, this system was not paid attention too much, especially in its data gathering aspect and offering on-time information submission.

Traditional costing method deviates product costs because of its cost division methods. Traditional costing method emphasized on production volume and assigns all overload costs by a certain rate to products. But, ABC method assigns costs more properly.

Traditional costing method overstates costs of large products and understates costs of small products. It also overstates overload costs for high-produced products and understates overload costs for low-produced products. Such deviations often intensify each other so that cost of a product may be over or understated.

If resources for a unit of a product are not directly proportional to its other resources, traditional costing systems that depend product unit, report product costs improperly. Here are samples of cases that cause improper reporting:

- Diversity of production volume
- Diversity of production complexity
- Diversity of physical size of products
- Diversity of raw materials

The effects of different diversities can be recognized by ABCS. Each diversity needs an activity motor. Since traditional costing system uses a certain basis for division of overload costs, this deviates finished price of products. ABC can be implemented in companies with much overload cost and much product diversity (diversity in volume, physical size, complexity, and raw materials). Product diversity causes ABCS to determine overload costs properly. In turn, this causes proper finished price. Ongoing products and end of period finished products cause different profit reports between ABCS and traditional costing system. Ongoing products and end of period finished products cause conveyance of costs to next period. But, if there is not end of period inventory, reported profits for both systems will not be different very much.

RESEARCH METHOD

Since selection of research method depends on the goal and nature of research subject, survey method was selected.

MEASUREMENT TOOLS AND DATA GATHERING METHODS

One of the most important sections of a research is data gathering and editing. The selection of data gathering method depends on research nature, data type, and limitations.

Some studies use all recognized methods (interview, observation, questionnaire, etc.). In this research, the researcher has used the following methods:

- a) Library
- b) Interview
- c) Questionnaire

DATA ABRIDGEMENT

a) Library method

For assumption 1, this method says that share of overload is high. Table 2 shows comparison of overload costs to total finished price costs, including direct material costs and direct remuneration costs for three years.

TABLE 2: OVERLOAD COSTS IN PRODUCTION

Item	2012	2011	2010
Production overload	48%	53%	48%
Direct materials	42%	34%	40%
Direct remuneration	10%	12%	12%
Total	100%	100%	100%

b) Interview

The researcher interviewed with managers and experts since they were colleagues of him. So the researcher could gather data by direct observations. Table 3 shows production complexity in ASI. Table 4 shows production diversity in ASI.

TABLE 3: COMPLEXITY IN ASI

Equipment / operation	Description
Electric arc furnace	To prepare primary melt, dephosphorization, and initial analysis set (20 ton)
Ladle furnace	To final set of analysis, temperature, desulfurization, and melt homogenization (20 ton)
Vacuumed degasification and decarbonization system	To decrease of remove dangerous gases in melt and decrement of carbon in stainless steel (20 ton)
Drip melting	To melt and treat steel and to increase its metallurgical properties
Heating furnaces and heat operations	To preheat, heat, and heat operations in different capacities (max. 90 ton)
Open die press	Hydraulic press to produce sections larger than 350 mm and hollow sections (3150 ton)
Four-hammer forging machine	To produce round, square, and stair sections less than 350 mm
Vertical furnaces for volume hardening	To tamper sections up to 1.6 m in diameter and 13.5 m in length and 20 ton
Warp-removal press	To remove cold and hot warps (1000 ton)
Induction hardening machine, cold roller	To harden with 30-70 mm in depth and 18 ton roller
Horizontal hardening machine, cold roller	To harden with 30-70 mm in depth and 20 ton roller
Gas tamper furnace (50 ton)	To tamper cold rollers (50 ton)
Under-zero quench operation tanks	Under-zero quench operations of rollers in min -90°C
Oil tamper furnace (20 ton)	To tamper cold rollers (20 ton)
Roller grinding machines	To grind rollers with 1 μ m precision (20 ton)
Milling and reaming machines	To machine middle and final steps of cold rollers

TABLE 4: PRODUCTION DIVERSITY IN ASI

Steel group	Standard number
Simple carbon steels and heat operations	ASTM A105, ST52, DIN1.1191, 1.7218, 1.6582, 1.7225, A694
Hardened steels	DIN1.7131, 1.5920, 1.5919, 1.5752, 1.7147, 1.7149
High temperature resisting steels	DIN1.7335, 1.8070, 1.7258
Cold-operation tool steels	DIN1.2436, 1.2379, 1.2080, 1.2767, 1.2510, 1.2550
Hot-operation tool steels	DIN1.2367, 1.2365, 1.2344, 1.2567, 1.2714, 1.2716
Carbon tool steels	DIN1.1730, 1.1740, 1.1525, 1.1545, 1.1645
Spring steels	DIN1.1248, 1.8159
Plastic mold steels	DIN1.2312, 1.2083, 1.2311
Stainless steels	DIN1.4006, 1.4012, 1.4057, 1.4301, 1.4401, 1.4404
Fireproof steels	DIN1.4841, 1.4828
Fast-cut steels	DIN1.3207, 1.3255, 1.3343

Production diversity in ASI is so that minimum production is 10-15 ton, and it reaches to 30 ton for some steels such as stainless steels that need melting support.

One of the most diverse parameters in ASI is physical size (table 5).

TABLE 5: DIVERSITY OF PHYSICAL SIZE

Section shape	Dimensions
Round and stair	80-100 mm
Square	80×80 to 100×100 mm
Flat	60×140 to 400×1800 mm
Ring	Inside min 350 and outside max 3400 mm
Cylinder	Inside min 200 and outside max 1300 mm
Disc	Max 2000 mm
Shapeless	Max 40 ton

C) QUESTIONNAIRE

The questionnaire contained 24 questions by Likert 5-option scale (very low, low, medium, high, very high). To complete the questionnaire, the researcher has went to the offices of managers and experts. These persons were familiar with financial affairs and ASI. Then Excel and SPSS were used to analyze data.

VALIDITY AND RELIABILITY OF MEASUREMENT TOOLS

The views of experts were used to increase validity of research tools (library, interview, questionnaire). Reliability of test was measured by Cronbach's Alpha, which was equal to 0.79625 that shows suitable reliability. The best reliability is >0.70.

STATISTICAL METHOD

Statistical methods were used in two methods:

- Descriptive statistics:** This method merely describes society and its goal is calculation of society parameters. If values and indices are calculated by counting all elements of a society, it is called "descriptive statistics". Descriptive statistics indices are: table, average, dispersion, SD, etc.
- Statistical inference:** Here we suggest a special kind of statistical inference called "statistical hypothesis tests". In this research, statistical hypothesis test is:

$\mu > 3$: H_0 is confirmed

$\mu \leq 3$: H_1 is rejected

T Test was used to examine data and statistical sample. In this research, Lickert Test (very high (5), high (4), medium (3), low (2), very low (1)) was used to estimate μ . So, the assumption is confirmed by confidence interval of 95% ($\alpha=5\%$; significance level<5%). If upper and lower limits are positive in 95% confidence interval and the statistic is not negative, then the assumption is evaluated higher than average.

If H_1 is confirmed, it indicates that ABCS is applicable in ASI. If H_0 is confirmed, it indicates that ABCS is not applicable in ASI.

ANALYSIS OF ASSUMPTIONS

$\mu > 3$: H_0 = There is an effective factor on ABCS in ASI.

$\mu \leq 3$: H_1 = There is no effective factor on ABCS in ASI.

Table 6 shows descriptive statistics indices for effective factors on implementation of ABCS. The average value for 50 samples is > 4 and SD is max 0.81117. As table 7 shows, $\alpha=5\%$ (significance level<5%), then H_0 is confirmed.

TABLE 6: DESCRIPTIVE STATISTICS INDICES

	N	Mean	SD	Std. Error Mean
Sub-main assumption 1	50	4.7	0.38244	0.05408
Sub-main assumption 2	50	4.61	0.24826	0.03511
Sub-main assumption 3	50	4.0667	0.76190	0.10775
Sub-main assumption 4	50	4.46	0.73183	0.10308
Sub-main assumption 5	50	4.1933	0.81117	0.11472
Sub-main assumption 6	50	4.5	0.31044	0.04390
Sub-main assumption 7	50	4.74	0.35341	0.04998
Sub-main assumption 8	50	4.4667	0.26937	0.03810

Table 7 shows output of SPSS software for single-sample T Test.

TABLE 7: SINGLE-SAMPLE T TEST

Test value = 3						
Sub-main assumptions	T	df	Sig.	Mean difference	95% confidence interval	
					Lower	Upper
Sub-main assumption 1	31.432	49	0	1.7	1.5913	1.8287
Sub-main assumption 2	45.857	49	0	1.61	1.5394	1.6806
Sub-main assumption 3	9.899	49	0	1.06667	0.8501	1.3832
Sub-main assumption 4	14.302	49	0	1.46	1.3549	1.6651
Sub-main assumption 5	10.403	49	0	1.19333	0.9638	1.4339
Sub-main assumption 6	34.167	49	0	1.5	1.4118	1.5882
Sub-main assumption 7	34.814	49	0	1.74	1.6396	1.8404
Sub-main assumption 8	38.5	49	0	1.46667	1.3901	1.5432

As you see in table 7, upper and lower limits in confidence interval of 95% are positive and T statistic is positive, too. This shows that the views of respondents for the effective factors on implementation of ABCS are higher than the average. Thus H0 is confirmed and H1 is rejected. So, there are effective factors on implementation of ABCS in ASI.

CONCLUSION

Regarding to the results, we conclude that there are effective factors on implementation of ABCS in ASI. Therefore, implementation of ABCS in ASI is feasible. Excess changes in economics of alloy steel have changed its conditions significantly. International competence and rapid new technologies have encountered this industry with major modifications. Thus, management accounting is changing beside changes of production systems. Usage of modern costing management in this industry increases its competitive power and provides conditions to produce more qualitative and cheaper products. ABCS can provide better information for decisions and helps diagnosis of none value-added costs. ABCS helps managers to understand capital cost and investment better. It also helps managers not to decide by after-tax profit, but follow long term programs and improve capital resources by considering economic efficiency. However, this system will not improve activities of a company automatically, but it provides information affecting efforts of managers to improve their companies.

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