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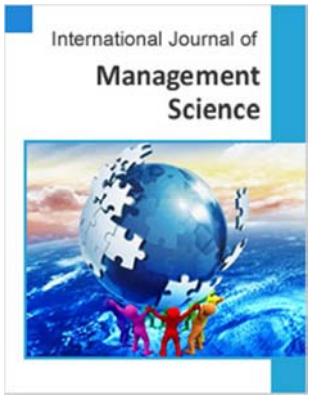

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Profitability by Selling Below the Average Unit Cost: Lean Cost Accounting and a Real Application

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Abstract
Recent years, manufacturers are increasingly interested with lean thinking for several reasons, such as reduce costs, raise profits, cash flow and stock price, improve productivity, enhance flexibility and create better value for their customers. "Lean" philosophy, derived from Toyota Production Systems, was focused on minimizing seven wastes from the system. These are overproduction, unnecessary transportation, inventory, motion, defects, over-processing, and waiting. This philosophy is being implemented day by day with increasing number of firms. Manufacturers and academicians have developed new lean approaches as an implementation of "lean thinking", such as lean production, lean management, lean cost accounting, etc. In this paper, lean cost accounting methods, value stream costing, calculating the profitability of an order using value stream costing, lean approach to decision making according to profitability of an order, and a Box Score to show strategic decision will be studied and discussed. Also how to profit by selling below unit cost will be showed with an application that had applied to a medium-sized hand tool manufacturer lean firm in Turkey. To the author's knowledge, this will be the first accounting study which uses the lean philosophy - "lean cost accounting".

1. Introduction

Lean is the philosophy of how a company operates the business. Leanness focuses on minimizing seven wastes from the system. These are overproduction, unnecessary transportation, inventory, motion, defects, over-processing, and waiting. The goal is to progress toward making processes flow and add value instead of the traditional batch and queue method characterized by many manufacturers with roots in the mass production system [1].

Lean thinking changes an organization by transforming top-down, project-driven project improvement into a culture of empowered teams focusing on continuous process improvement and creating value for the customer. A team-based organization requires a different type of accounting system than a traditional organization. Benefits of leanness include reduced inventories and shorter lead times plus improved quality, less damage and obsolescence, and increased flexibility due to process simplification [1].

With implementation of a lean manufacturing strategy, the organization simplifies its internal accounting reporting system, eliminates inventory tracking and overhead allocations, and increases its use of Value Stream Costing (VSC) [2].

According to The Economist, lean methods have enabled US manufacturers to significantly increase their pace of productivity improvement in the last five years [1]. Not only manufacturers, there is a growing application of lean thinking in the service

sector. Banks, insurance companies, and other financial services companies report excellent results from lean improvement [3].

In this paper, lean cost accounting methods, value stream costing, calculating the profitability of an order using value stream costing, lean approach to decision making according to profitability of an order, and a Box Score to show strategic decision will be studied. Also how to profit by selling below unit cost will be showed with an application that had applied to a medium-sized hand tool manufacturer lean firm in Turkey. The rest of this paper is organized as follows: the lean accounting is described in Section 2. A brief description about the firm will be presented and an application will be studied in Section 3, also strategic decisions and results will be given in this section. In Section 4, results and future research directions are discussed, which concludes the paper.

2. Lean Accounting

Traditional accounting systems often use full overhead absorption and were designed to support management principles like mass production, top-down command and control, department optimization and budgeting. As a result, what becomes important throughout the organization is full utilization of all resources, average part cost and overhead absorption [1].

Traditional accounting system is focused on real cost of product calculation and is suitable for mass production. Mass production era is over and new accounting systems are needed for modern manufacturing strategy, such as lean manufacturing. Lean accounting has been developed to support lean companies and avoid problems with traditional accounting system [4].

Much intellectual effort has been applied to develop alternatives to traditional cost accounting, such as activity-based costing. But no system has yet been developed which reflects the basic fact that most operating expense is attracted to products whilst they are not being manufactured, whilst they are in work-in-progress, being inspected, moved and stored [5].

It is important for lean companies that their accounting, control, and measurement methods change substantially. Traditional cost accounting methods are not benign, also harmful for the lean transformation. Lean accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking. Most companies embarking on lean manufacturing soon find that their accounting processes and management methods are at odds with lean changes they are making. The reason for this is that traditional accounting and management methods were designed to support traditional manufacturing; they are based upon mass production thinking [6]. Lean accounting supports lean manufacturing, lean design, lean logistics, and lean management to form a totally lean company.

The reasons for changing traditional accounting methods are [7, 8, 9]: Traditional cost accounting methods cause wrong measurement and wrong costs. They motivate people to use non-lean procedures, such as running large batches and building inventory. Lean cost accounting provides better decision making, and more understandable information for financial reports as said in Cunningham and Fiume [7], "*the average recipient of a standard cost-based profit and loss statement does not understand the document in his hands. It communicates nothing. Worse still, for those few that do understand it, these statements fail to give meaningful information about what is really happening in the operation*."

Also traditional accounting systems lead to complex systems of data collection and reporting. Traditional companies tend to focus on cost, lean companies focus on customer value as stated in Application Section. In lean companies, sometimes products can be sold under their cost that calculated with traditional cost accounting methods.

Some of the benefits of lean accounting include: Lean accounting increases sales, because it provides better information for decision-making. Lean accounting clearly identifies the financial impact of lean improvements, reduces costs, saves money and time by eliminating much of the waste associated with traditional accounting and control systems, motivates long-term lean improvement through lean-focused information and measurements [6].

Lean accounting assumes profit is from maximizing flow on actual demand (pull signals) from customers; waste is any resource that impedes flow, control is achieved through attention to flow and waste and excess capacity provides flexibility. An early step in lean is to create a value stream map, that is designed to show material flowing from left (raw material) to right (finished product) and information flowing from right to left [10], to identify all the specific actions to bring a specific product [1].

Value stream mapping is the starting point for lean manufacturing and is also the starting point for lean accounting. The purpose of a value stream map is to enable us to see the flow of materials, information, and sometimes cash, through the value stream. Performance measurements are established around value streams and their production cells and non-production steps. The financial impact of lean improvement is calculated from the current state and future state value stream maps. Value stream costing is driven from the value streams defined by their maps [8].

3. Application

On a continuing basis, eliminating barriers to flow, minimizing the value stream costs, continuous improvement through work teams and eliminating inventory and overproduction become the goals of management. Instead of focusing on individual jobs, departments and efficiency and utilization, the flow of the value stream becomes paramount. Many wasteful transactions that were important in the traditional accounting environment can be eliminated. As non-value added steps are eliminated, the streamlined

processes result in additional available capacity. The financial impact comes as you make decisions on how to use this capacity (and cash flow from reduced inventory) [1].

In the application a medium-sized hand tool manufacturer lean firm in Turkey was studied. The firm produces brush, roller brush, painting sets, painter pot, paint tank, etc. The production of brush was chosen and the costs were calculated. Firstly the value stream of the current state was studied and then some improvements to the processes were done.

As shown in Table 1, total costs of the company are 7,693,410 Euro and the total quantity of production is 9,360,000. With these, average unit cost can be calculated as 0.822 Euro.

Moving to lean accounting is a radical change from traditional accounting [1]. When using value stream costing, it is not important to calculate a product cost. Almost all of the companies using traditional accounting to calculate the unit cost and have a decision with respect to unit cost. But the analysis in Table 2 shows that selling under unit cost is possible and sometimes profitable. This helps companies to make decisions more feasible.

In Table 2, it can be seen that in case of current sale price of the brush is 1.16 €, its unit cost is 0.822 €, and new order from 0.60 € and it is profitable to accept the order; Value Stream Return increases from 5.02% to 9.44%. And also this method can be used for current-future state, to produce or to buy from other providers (outsourcing), or to purchase machine and increase production, and their comparisons as shown in [11]. According to the Value Stream Profit and Value Stream Return, the most profitable decision can be made easily with this method.

It is not possible to make good decisions without a complete understanding of the value stream performance. To present a three-dimensional view of the value stream's performance, the box score is offered. This format is favored in many lean companies because it can be used by all levels of the organization. It clearly displays the current and future state and helps to identify areas for lean improvements. The box score is divided into three sections: operational performance, capacity information, and financial performance. The information is shown on a single piece of paper and is readily understandable to people using it. It provides the visual cues needed to drive change and highlight problem areas [9].

Table 1. *Value Stream Costing (VSC).*

CELL VALUE STREAM	
Total Costs (Euro)	7,693,410
Quantity of Production	9,360,000
Average Unit Cost (Euro)	0.822
COSTS	CELL COSTS (Euro)
Material Costs	4,990,028
Employee Costs	174,997
Personnel Costs	567,117
Vehicle Costs	33,834
Communication Costs	10,392
Building Costs	473,539
Stationary Costs	5,167
Transport Costs	11,461
Education Costs	3,748
Traveling Costs	19,032
Consultancy Costs	85,213
Other Costs	154,534
Material Costs	448,834
Maintenance Costs	42,450
Depreciation	673,064
TOTAL	7,693,410

Table 2. *Profitability of an order using VSC.*

Current sale price: 1,16 €/unit			
New order: 0,60 €/unit			
	Current profitability for 200,000 unit	**New order (1,000,000 unit)**	**Future profitability for 1,200,000 unit**
Revenue (€)	232,000	600,000	832,000
Materials Cost (€/order)	106,625	533,123	639,747
Conversion Cost (€/order)	113,723	-	113,723
Value Stream Profit (€/order)	11,653	66,877	78,530
Value Stream Return (%)	5.02		9.44

As it is known that, the biggest short-term contribution of lean improvement is to increase the available capacity of the company. In Table 3, the available capacity of the studied lean company is 85% in current state. Lean transformations eliminate waste and create additional capacity. By this way, the hand tool manufacturer company that aims to increase its capacity, increases its productive capacity from 85% to 93%. And all the changes (operational, capacity, and financial) can be seen easily from Table 3 and using this table the strategic decisions can be made according to the company's strategies.

Table 3. *Box Score of brush.*

		Current State	**Future State**	**Change**
OPERATIONAL				
Dock-to-Dock Days	Days	7	2	5
First Time Thru	%	95	100	5
On-Time Shipment	%	100	100	-
Units per Person	€/Person	33,987	37,763	3,776
Average Costs	€/Unit	0,822	0.740	0,082
CAPACITY				

		Current State	Future State	Change
Productive	%	85	93	8
Non-Productive	%	11	5	6
Available Capacity	%	4	2	2
FINANCIAL				
Revenue	€/month	903.475	1.003.861	100.386
Material Cost	€/month	415.836	374.252	41.584
Conversion Cost	€/month	457.419	411.677	45.742
Value Stream Profit	€/month	30.220	217.932	187.712
Value Stream Return	%	3.34	21.71	

4. Conclusion

It is important for lean companies that their accounting, control, and measurement methods change substantially. Traditional cost accounting methods are not benign, also harmful for the lean transformation. But traditional accounting measures may indicate leanness has actually increased costs and the chance successfully moving to a lean culture greatly diminish. Lean accounting is the general term used for the changes required to a company's accounting, control, measurement, and management processes to support lean manufacturing and lean thinking.

Companies using lean accounting have better information for decision making; have simple and timely reports that are clearly understood by everyone in the company; understand the true financial impact of lean changes; and focus the business around the value created for the customers. And lean accounting actively drives the lean transformation. This helps the company to grow, to add more value for the customers, and to increase cash flow and value for the stockholders and owners [9].

In the application, a medium-sized hand tool manufacturer lean firm in Turkey was studied and lean cost accounting methods, value stream costing, the profitability of an order using value stream costing, lean approach to decision making according to profitability of an order, and a Box Score to show strategic decision were discussed. Also how to profit by selling below unit cost was showed with an application that had applied to a medium-sized hand tool manufacturer lean firm in Turkey. They all help us to drive change, highlight problem areas and make strategic decisions.

For further researches, it is aimed to apply the lean philosophy to a non-lean firm, then calculating the differences on operational, capacity, and financial changes after the lean philosophy and lastly examining the profitability of an order using lean accounting.

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