Absorption Costing and Variable Costing: How Costing Methods could Influence Sustainability Strategies for Inventory Production

By
Lucy U. Diala
California State University Fresno

Abstract: There is a need for future accounting students to be taught ethics along with social responsibility (Lawson et al (2014). Currently, social responsibility topics emphasize sustainability/Environment, Social and Governance (ESG) impacts and current college students value ESG as an important consideration in choosing their career (EY 2023). However, there are few new materials covering ESG in accounting education as accounting professionals of the future need skills in assessing financial metrics and sustainability indices (Bakarich et al. 2023; Butcher 2022, IFAC 2016). Thus, this classroom case provides a timely perspective on how ESG and ethical considerations can be integrated into upper-level managerial accounting courses using a data analytics approach. 124 students in a U.S. public university located in the pacific region participated in the case. Their case solutions and feedback provide evidence of learning efficacy in this study.
I. INTRODUCTION

Background

In today's business environment, inventory doesn't merely represent stored value or assets in transit, it embodies a firm's carbon footprint, resource utilization, and its broader commitment to sustainable practices (Beusch et al. 2022; Battaglia, et al. 2016). Inefficient inventory practices can lead to wastage, increased emissions from storage and transportation, and a heightened consumption of resources. Given these ramifications, it's imperative for firms to make informed decisions about their inventory processes using cost accounting data. This study focuses on strengthening graduate preparedness for management accounting’s transformative role amidst escalating corporate ESG emphasis. Future accounting professionals need skills in assessing financial metrics and sustainability indices (Bakarich et al. 2023; Butcher 2022, IFAC 2016) to help firms align objectives when optimizing inventory management and be able to do so from an ethical standpoint. An MBA managerial accounting class and cost accounting students in a united states public university participate in an integrated approach to inventory production, whereby variable and absorption costing accounting systems are the internal-external accounting measures applied to help students make decisions in a case scenario that have business sustaining implications and opportunities for ethical considerations.

Innovative Approach to Teaching Sustainability

Absorption Costing Vs. Variable Costing Systems as Vehicles Facilitating the Pedagogical Integration of Goal 12 and 13 within the Rigors of Internal Accounting

Cost accounting systems provide the building block of data used in internal operations, and help organizations make strategic decisions to achieve short- and long-term goals. These systems can facilitate the analyses of both financial and non-financial information; thus, they can
be used as a foundation for systems capable of tracking and managing non-financial data relevant to a company’s sustainability targets (Lueg and Radlach 2016; Balakrishnan et al. 2012; Daowadueng et al. 2023). PricewaterhouseCoopers (PwC) has demonstrated a similar approach in the use of accounting systems for climate data tracking. PwC adopted the use of the simple financial ledger to internally track a company’s carbon emissions, by replicating the monetary debit and credit process, in a carbon ledger system (PwC 2023). Costing systems can be used to facilitate the achievement of sustainability goals such as with the carbon ledger. Furthermore, companies are more likely to achieve successful sustainability integration into their operations when they retool management accounting systems of which they already have competency as opposed to creating and having to learn entirely new tools (Beusch et al. 2023; Engert et al. 2016). In the ensuing discussion, this study explains two accounting methods used for tracking inventory manufacturing: the absorption and variable costing systems.

**Alignment with SDG Goal 12 (Ensure Sustainable Consumption and Production Patterns) and Goal 13 (Climate Action).**

The absorption and variable costing systems when used in the internal reporting of inventory could affect a company’s costs and profit/loss potential and decisions related to their use could facilitate a company’s progress toward their carbon emissions reductions targets or drive them toward using up more energy and generating emissions that result in wastage. Income statements generated using the absorption costing approach are generally structured in the same format as the income statement required for external reporting and as such the focus for this discussion is how this method when used internally as well as externally could have impacts on Goal 12, in terms of sustainability risks and production patterns that may have ethical
implications. It also highlights how accounting decisions could be made in the context of absorption or variable costing that could lead to misalignment with Goal 13 – taking urgent action to combat climate change. Exposing students to these implications provides a framework to prepare them to make decisions in internal accounting use that moves the companies they would serve in the future, close to alignment with Goals 12 and 13.

Using an absorption costing approach means that fixed costs are stored in inventory until the goods are sold. In other words, once raw materials are converted to finished goods in the manufacturing process of a certain unit of product, the resources used for manufacturing those specific units of products are expensed only when products are sold. This means that the costs of units not sold (ending inventory) for that period, are deferred to a future period (Datar and Rajan 2021). Thus, the absorption costing system when used internally as well as externally could portray a delayed sense of the true cost of manufacturing excess inventory, for a given period. This is because inventory not sold in the period will be capitalized in the balance sheet, and costs of excess inventory would simply be deferred. And as such, costs deferred to the balance sheet as assets can be recognized as expenses only when the units are sold. Nonetheless, the risk of having over-consumed resources and the associated over-use of carbon to build the products exist regardless of whether the units eventually get sold or not.

From the standpoint of achieving sustainability, the absorption costing system when used as both the internal and external accounting system defers the impact of carbon consumption, implying the doing the opposite of urgently combating climate action, while also creating incentives to defer and not recognize this impact as it makes profit appear higher in the short run when a firm produces more than it sells. Variable costing recognizes the risks and costs associated with production and carbon consumption when goods are produced, and the carbon is
consumed. Variable costing also disincentivizes carbon use by penalizing the firm more directly and timely when it over-produces.

As an ethical concern, the potential to manipulate performance also exists in inventory production since the choice of costing approach could give an impression of higher performance potentially influencing the bonuses and promotions that managers may gain during the current period. And since the absorption costing system is also the system used for external reporting, the tendency to use this system alone for inventory building decisions could be tempting. On the other hand, adopting a variable costing system would necessitate also having to use an absorption costing system for the purposes of external reporting (Datar and Rajan 2021). Therefore, for a company wishing to integrate Goal 12 and 13 into its enterprise systems, taking a second look at the implications of adhering to the use of absorption costing alone, possibly to avoid the fees that would accompany having two internal reporting systems for inventory production may be beneficial towards moving closer to achieving sustainability and climate action targets.

Furthermore, production volumes left at the discretion of the manager could be subject to reasonable seeming justifications to potentially using only the absorption costing system and the production of more ending inventories. For instance, the manager could justify increased production based on an anticipated customer demand due to economic trends, market leanings towards the product and fear of product shortages. However, if these reasons are not backed up with a guaranteed customer base and demand for the specific company’s products, the overproduction could turn out to be an expensive risk on resources while the production manager benefits from stock incentives, bonuses or promotions based on the operating income value only.
II. CLASSROOM APPLICATION

Classroom Case Premise

Daveco, Inc. manufactures cylindrical automotive cell batteries used in electrical vehicles (EV), under the brand name Lumix0. After several years of manufacturing and selling Lumix0, the company expanded operations and now has three plants named Havana, Banabe and Merlen, located across three states in the United States. In the early years of operation, Daveco relied on standard costing approaches in producing inventory, and used industry trends/benchmarks to determine how many units of Lumix0 to produce. However, industry trends have become unreliable in predicting the accuracy of sales of inventory for cylindrical automotive cell batteries as many EV manufacturers have begun using prismatic cells in some of their vehicles. Also, Daveco’s customers have become conscious of adhering to the United Nations Sustainable Development Goals (SDG) and indicate that as part of the EV manufacturers’ tracking of alignment with these goals, they would be considering whether to continue ordering Daveco’s Lumix0, pending yearly assessments on Daveo’s demonstration of commitments to Goal 12 (ensure Sustainable Consumption and Production Patterns) and 13 (take urgent action to combat climate change and its impacts).

In the production of Lumix0 battery cells, 41.48 kWh of energy per kilowatt hour of cell capacity are consumed per unit, while Daveco has also determined that 10.33 kg of CO\textsubscript{2}-eq is emitted per kWh of battery cell capacity produced\textsuperscript{1}. In 2015 the Banebe plant switched to Just in Time (JIT) production processes, a manufacturing system that produces each component of inventory only as and when needed in the production line. In the year 2018, Banebe produced and sold 10,000 units of Lumix0, and the plant manager was rewarded with stock incentives.

\textsuperscript{1} See Degen and Schütte (2022) Life cycle assessment of the energy consumption and GHG emissions of state-of-the-art automotive battery cell production.
Towards the end of 2018, Daveco’s CEO proposed the increase of the Havana and Merlen plant managers’ stock bonus incentives tied to increasing operating income in the coming year, 2019. Daveco’s plant managers have the discretion to choose their internal accounting methods, provided that the external accounting methods are those accepted by the Internal Revenue Service (IRS). In 2019, managers of the Havana and Merlen plant choose the absorption costing method for their internal reporting approach citing the added fees that would be incurred in paying the variable costing reporting of their internal operations, since Daveco would also need to provide the IRS an income statement using the absorption costing approach. The income statement used by the plant managers is also the data available to the CEO and shareholders. At the end of 2019, the data on units of Lumix0 produced and sold became available. Table 1 shows the data related to the production of Lumix0 for both the Havana and Merlen plants at the end of 2019, and the Banebe Plant for the 2018 year.

**TABLE 1: Details of production data for each of the 3 plants in the Relevant Period.**

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Havana Plant</td>
<td>Merlen Plant</td>
<td>Banebe Plant</td>
<td></td>
</tr>
<tr>
<td>Beginning inventory</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Production</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Sales</td>
<td>5,000</td>
<td>2,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Ending inventory</td>
<td>5,000</td>
<td>8,000</td>
<td>0</td>
</tr>
<tr>
<td>Selling price</td>
<td>$1,800</td>
<td>$1,800</td>
<td>$1,800</td>
</tr>
<tr>
<td>Variable manufacturing cost per unit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct materials cost per unit</td>
<td>$125</td>
<td>$125</td>
<td>$125</td>
</tr>
<tr>
<td>Direct manufacturing labor cost per unit</td>
<td>$55</td>
<td>$55</td>
<td>$55</td>
</tr>
<tr>
<td>Manufacturing overhead cost per unit</td>
<td>$70</td>
<td>$70</td>
<td>$70</td>
</tr>
<tr>
<td>Total variable manufacturing cost per unit</td>
<td>$250</td>
<td>$250</td>
<td>$250</td>
</tr>
<tr>
<td>Variable marketing cost per unit sold</td>
<td>$185</td>
<td>$185</td>
<td>$185</td>
</tr>
<tr>
<td>Fixed manufacturing costs (all indirect)</td>
<td>$1,250,000</td>
<td>$1,250,000</td>
<td>$1,250,000</td>
</tr>
<tr>
<td>Fixed marketing costs (all indirect)</td>
<td>$1,380,000</td>
<td>$1,380,000</td>
<td>$1,380,000</td>
</tr>
</tbody>
</table>

Each unit produced emits 10.33 kg of CO2-eq
Each battery cell uses 41.48 kWh of energy per kilowatt hour
**Case Requirement**

To determine how well Daveco Inc.’s production provided benefits to shareholders in relation to costs, perform the following:

1. Using an absorption costing approach and a variable costing approach, prepare income statements for the Havana and Merlen plants at the end of 2019 and the Banebe plant in 2018.
2. Consider the units produced and sold for each plant (Havana and Merlen in 2019 and Banabe in 2018) and perform a data analysis of the absorption vs. variable costing approach in terms of the behavior of total costs as a percentage of revenue and operating income as a percentage of revenue.
3. Write a reflection on the implications for the operating income reported to shareholders by each of the plant managers. How would the decision to build the inventory be different if the shareholders had been provided with both operating income statements? Are there any ethical concerns?
4. For each plant in the relevant period given, compute the carbon emissions and energy usage attributable to units produced and units not sold.
5. Perform analysis of data by visualizing (with charts/graphs) the information in requirement 4.
6. Write reflections on the impact of the accounting method used by the Havana and Merlen plants. How might the data reflected in both the variable and absorption costing approaches align or misalign with SDG Goals 12 and 13 by Daveco Inc?
7. Provide recommendations on strategies Daveco Inc. should implement in the future that might bring them closer to achieving SDG Goals 12 and 13. Include implications of alternative strategies.
Case Objectives

By implementing this case, students will be able to:

1. Analyze data and reflect on the ethicality of managerial incentivization to increase operating income given SDG considerations inherent in inventory production decisions.

2. Analyze variable and absorption costing systems and assess their use in inventory production decisions and how their usage might affect alignment with SDG goal 12 (Ensure Sustainable Consumption and Production Patterns).

3. Leverage data analysis tools to arrive at financial cost/benefit data and consider their impact in relation to achieving SDG goal 13 objectives.

4. Leverage data analysis tools to arrive at decarbonization or energy reduction recommendations in keeping with SDG Goals 12 and 13.

5. Examine the ethicality of excess inventory production having assessed costing systems and related carbon emissions/energy usage.